SERVICE MANUAL

SANYO

COLOUR VIDEO CASSETTE RECORDER

VTC-R4ME

Beta

CONTENTS

I. INTRODUCTION 1
II. CABINET DISASSEMBLY 2
III. CIRCUIT BOARD DISASSEMBLY 3
IV. CIRCUIT ADJUSTMENTS 5
A. POWER SUPPLY CIRCUIT 5
B. SERVO CIRCUIT 6
C. VIDEO PRE-AMP CIRCUIT 13
D. VIDEO CIRCUIT 16
E. AUDIO CIRCUIT 26
V. MECHANISM ADJUSTMENTS 28
A. JIGS AND TOOLS FOR ADJUSTMENTS ... 28
B. PREPARATIONS FOR ADJUSTMENTS 30
C. MAINTENANCE TIMETABLE 33
D. MECHANISM REPAIR AND PARTS REPLACEMENT 34
E. ADJUSTMENTS 45
F. TAPE PATH ADJUSTMENTS 48
G. USING METHOD OF MECHANISM JIG ....
VI. CIRCUIT DESCRIPTION 52
A. VIDEO CIRCUIT 52
B. SERVO CIRCUIT 65
C. SYSTEM CONTROL CIRCUIT 70

WM-11020

BETA-FORMAT VIDEO CASSETTE RECORDER SPECIFICATIONS

Color television systems	CCIR: B, G/PAL and B, G/SECAM standard colour TV NTSC: 3.58-MHz and 4.43-MHz (video signal)
Recording system	Rotary two-head helical-scan system
Tape speed	18.73 mm/sec. (CCIR), 20.00 mm/sec. (NTSC: βII), 13.33 mm/sec. (NTSC: βIII)
Recording time	215 min. (CCIR), 200 min. (NTSC: βII), 300 min. (NTSC: βIII) with L-830 cassette
Tape loading	Automatic loading (U-type)
Video cassettes	L-250, L-500, L-750 and L-830 Dimensions 96(W) x 25(H) x 156(D) mm
Tuner	8-channel varactor tuner
Tuner input	Channel 2 – 4, 5 – 12, 21 – 68
RF converter	Built-in UHF converter
Converter output	Channel 30 – 39 (adjustable); pre-adjusted to 36
Timer	Built-in digital timer, AM/PM 12-hour clock, 8 days-one programme timer
Tape counter	4 figures display electronic counter
Tape rewind memory	Push button setting
Fast forward time	Approx. 4 min. with L-750 cassette Approx. 4 min. with L-750 cassette

Electrical characteristics

Video output level	1 ±0.2 Vp-p
Video output impedance	75 ± 5 ohms
Audio output level	−5 dB
Video input level	0.5 – 2 Vp-p
Video input impedance	75 ± 5 ohms
Audio input level	−10 dB
Audio input impedance	High
Video S/N	More than 42 dB
Audio S/N	More than 40 dB
Horizontal resolution	250 lines
Audio bandwidth	50 Hz – 10 kHz

Other characteristics

Wow and flutter	Less than 0.3% (DIN)
Loading time	Less than 4 sec.
Unloading time	Less than 4 sec.
Power requirement	AC 110 – 240V ±10%, 50/60 Hz, 28W (36W with video camera)
Dimensions	480 (W) x 135 (H) x 350 (D) mm
Weight	8.6 kg

The power switch of this set is connected in the secondary circuit and does not disconnect the set from AC-power even if the switch is off (STAND BY) if the AC cord is connected to the AC line.

I. FEATURES

* Popular BETA recording format
* Four colour system: PAL, SECAM, NTSC 3.58 MHz, and NTSC 4.43 MHz with four video heads
* No voltage adjustment necessary
* Built-in preset VHF and UHF tuner (PAL & SECAM)
* Built-in 8-day, 1-event timer with everyday function
* Soft touch mechanism operation
* Digital tape counter with (0000) position memory
* Fast picture scanning, forward and reverse
* Still picture playback
* Wireless remote control

II. CABINET DISASSEMBLY

1. CASSETTE COVER

Remove the veil from Cassette Cover with small screw driver. Remove two screws (a) on the Cassette Cover as indicated, and remove the Cassette Cover.

2. CABINET TOP

Remove three screws (b) on the Cabinet Top as indicated, and carefully lift up the Cabinet Top.

3. BOTTOM PLATE

Place the VCR with the right side down on a soft surface, and remove seven screws (c) on the Bottom Plate as indicated.

4. FRONT PANEL ASSEMBLY

Remove six screws (d) securing Front Panel, and remove the Front Panel.

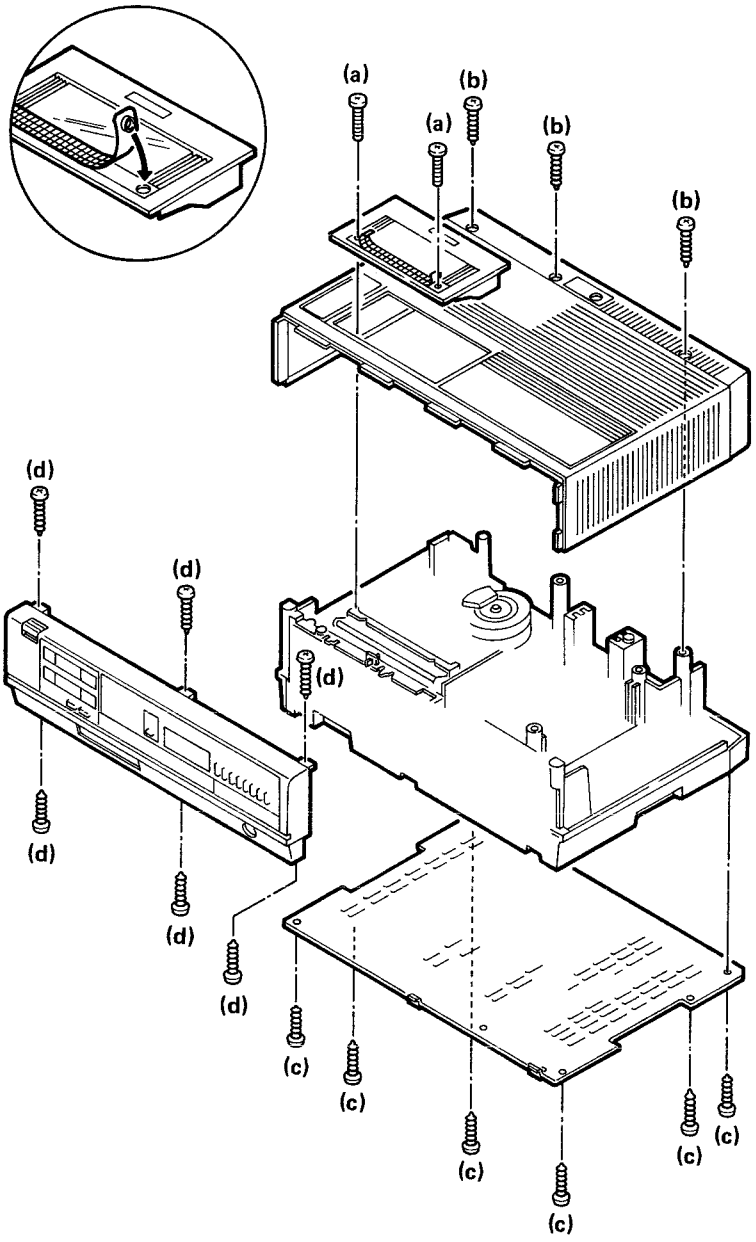


Fig. 2-1-1

III. CIRCUIT BOARD DISASSEMBLY

A. CIRCUIT BOARD LOCATIONS

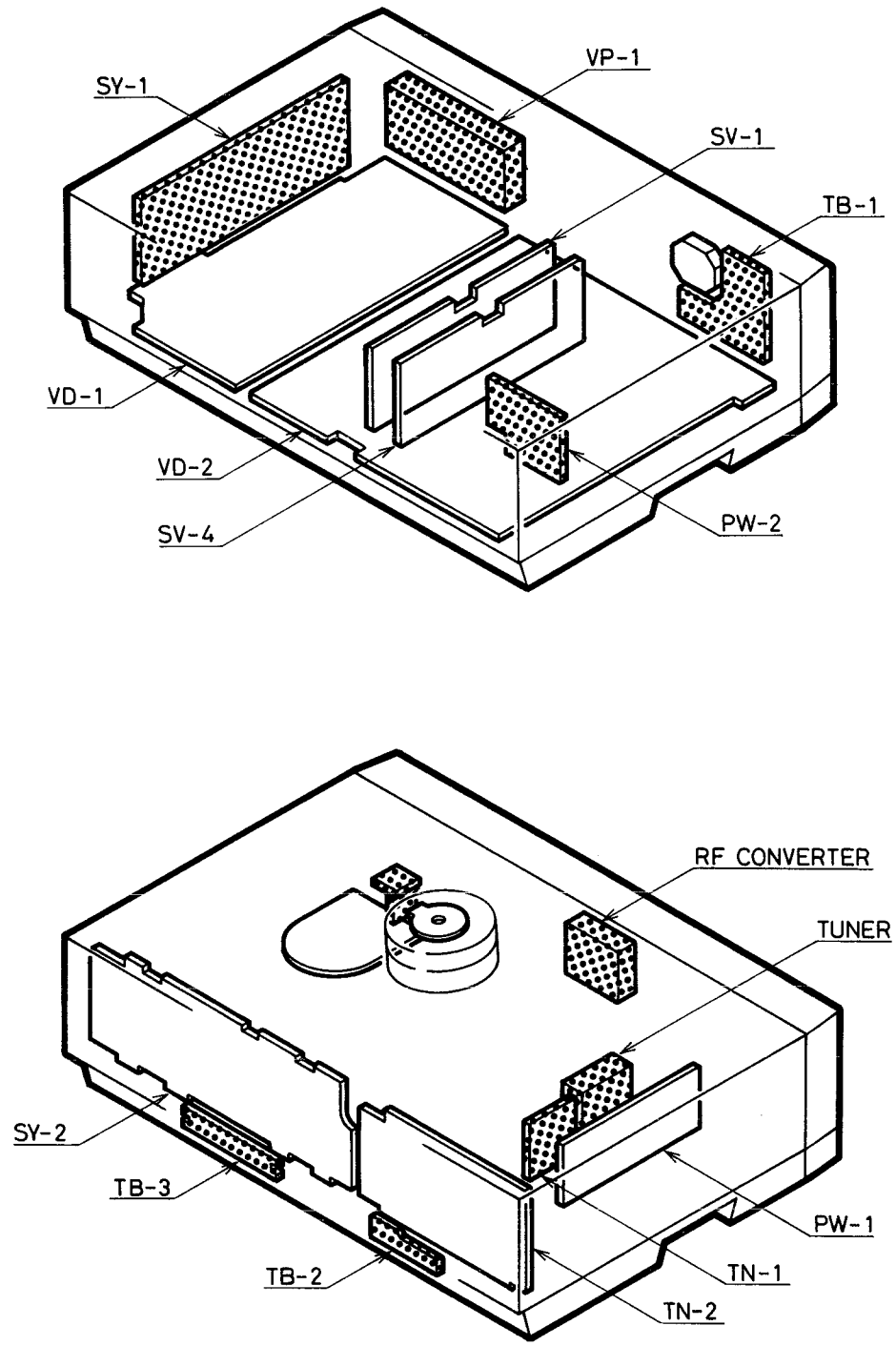


Fig. 3-1-1

B. CIRCUIT BOARD DISASSEMBLY

1. VD-1, VD-2 BOARD (VD-1: VIDEO and AUDIO CIRCUIT, VD-2; VIDEO CIRCUIT)

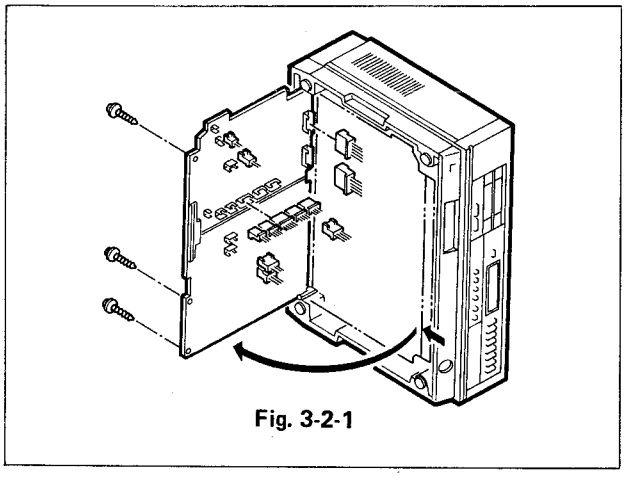


Fig. 3-2-1

2. SY-1 BOARD (SYSTEM CONTROL CIRCUIT)

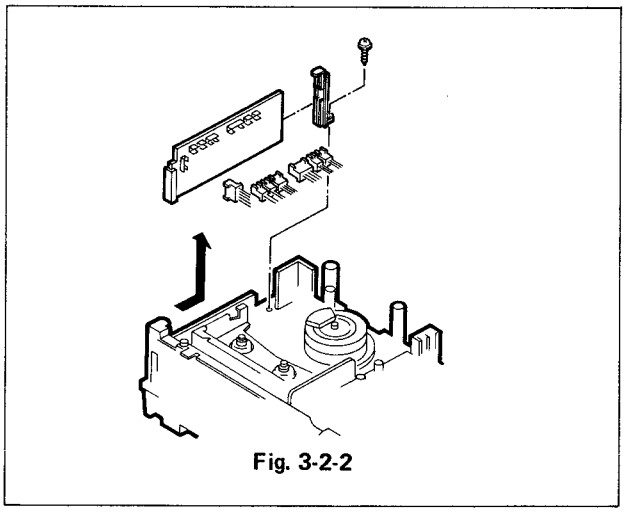


Fig. 3-2-2

3. SV-1, SV-4 BOARD (SERVO CIRCUIT)

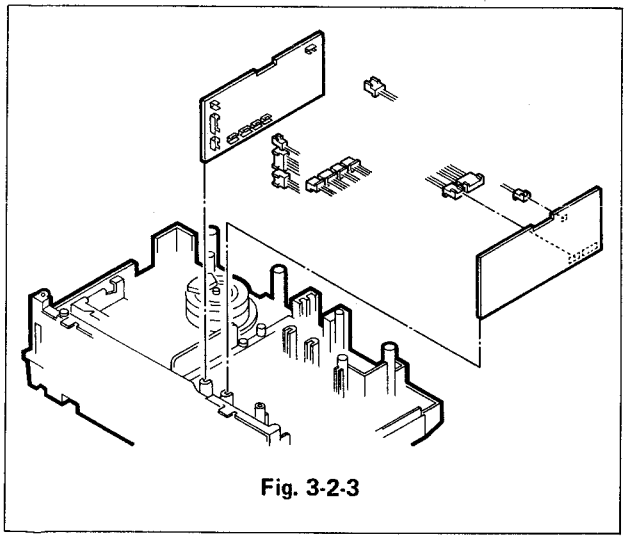


Fig. 3-2-3

4. PW-1, PW-2 BOARD (POWER SUPPLY CIRCUIT)

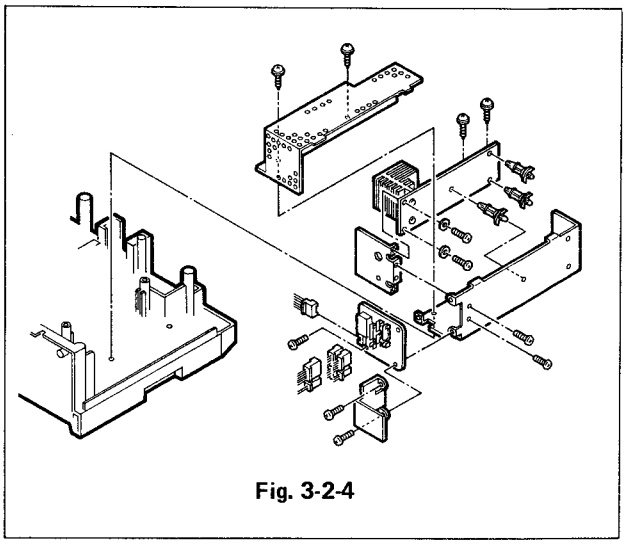


Fig. 3-2-4

5. SY-2 BOARD (SYSTEM CONTROL and TIMER CIRCUIT)

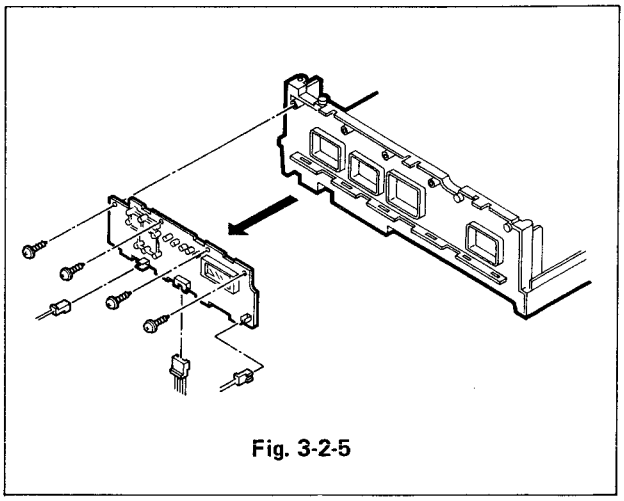


Fig. 3-2-5

6. TN-2 BOARD (TUNER CHANNEL PRESET CIRCUIT)

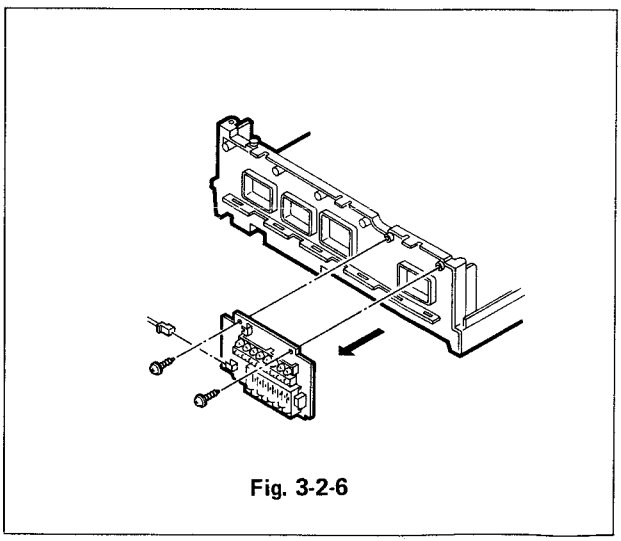


Fig. 3-2-6

Ⅳ. CIRCUIT ADJUSTMENTS

A. POWER SUPPLY CIRCUIT

1. +12V Adjustment

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR5001	TP5201	$12^{+0.1}_{-0}$ V	Digital voltmeter	POWER ON STOP mode

2. +9V Adjustment

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR5201	TP5202	$9^{+0.1}_{-0}$ V	Digital voltmeter	POWER ON STOP mode

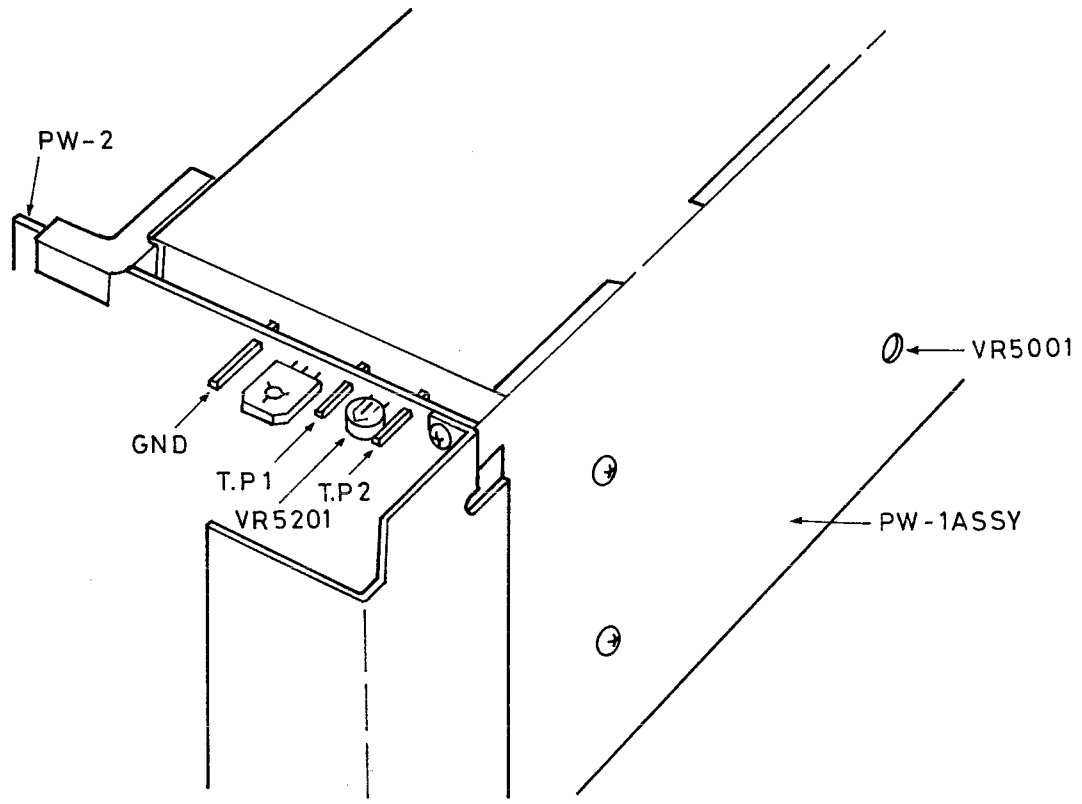


Fig. 4-1-1

B. SERVO CIRCUIT

1. Head Switching Position Pre-setting

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
All VR of SV-1	–	Center position	–	–

2. FWD APC Lock (PAL & SECAM)

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR4012	TP4002	4.0 ±0.2V	Oscilloscope	PAL or SECAM REC mode

3. FWD APC Lock (NTSC)

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR4001	TP4002	4.0 ±0.2V	Oscilloscope	NTSC REC mode

4. Head Switching Position (NTSC PG-A)

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR4004	TP4001 Video output terminal	7 ±0.5H Fig. 4-2-1	VJ-0093 Oscilloscope	NTSC PLAY mode

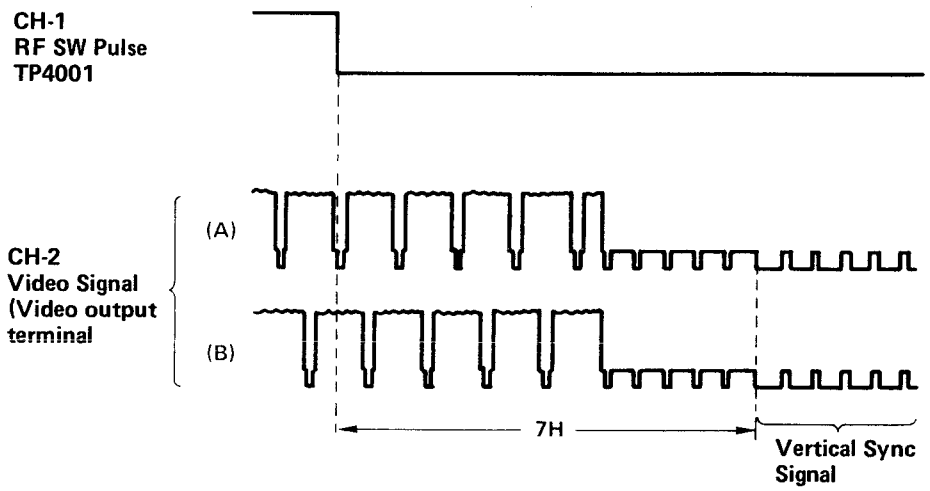


Fig. 4-2-1

5. Head Switching Position (NTSC PG-B)

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR4002	TP4001 Video output terminal	7 ±0.5H Fig. 4-2-2	VJ-0093 Oscilloscope	NTSC PLAY mode

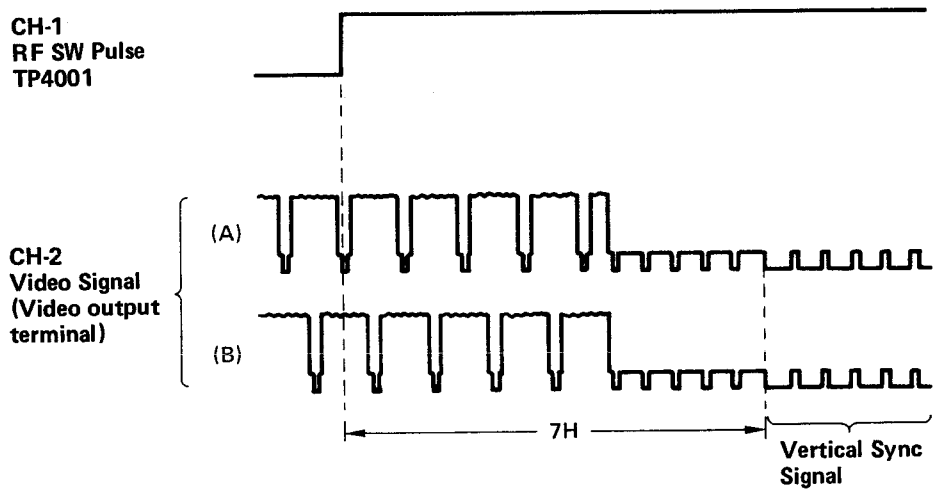


Fig. 4-2-2

6. Head Switching Position (PAL/SECAM PG-A)

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR4003	TP4001 Video output terminal	7 ±0.5H Fig. 4-2-3	VJ-0113 Oscilloscope	PAL PLAY mode

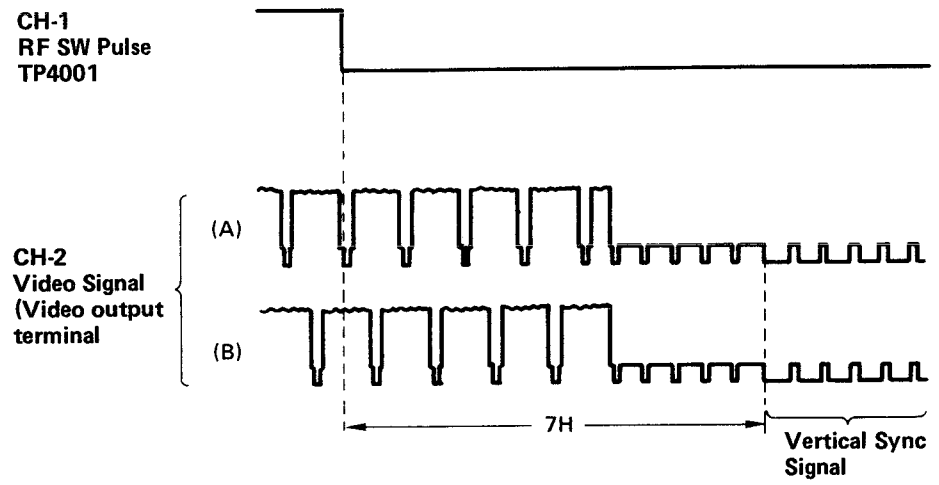


Fig. 4-2-3

7. Head Switching Position (PAL/SECAM PG-B)

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR4001	TP4001 Video output terminal	7 ±0.5 H Fig. 4-2-4	VJ-0113 Oscilloscope	PAL PLAY mode

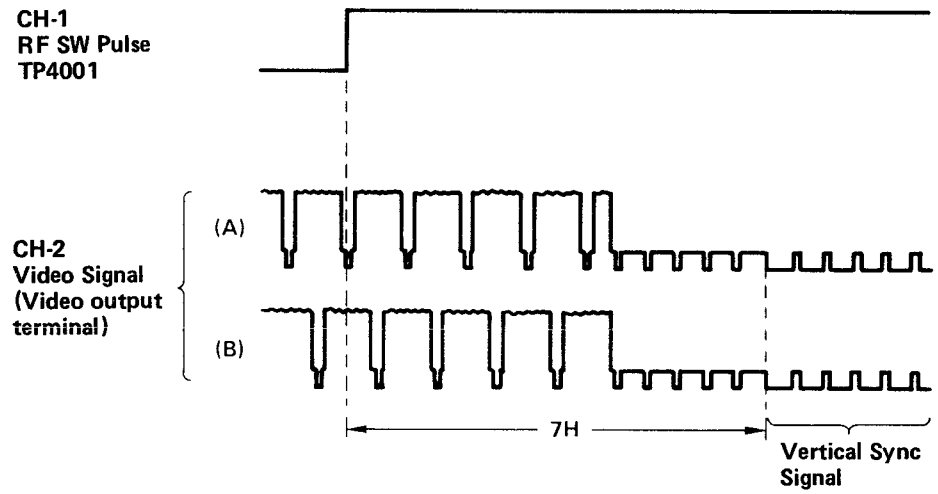


Fig. 4-2-4

8. FWD APL Lock Position (PAL/SECAM)

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR4006	TP4001 Video output terminal	7 ±0.5H Fig. 4-2-5	Oscilloscope	PAL or SECAM REC mode

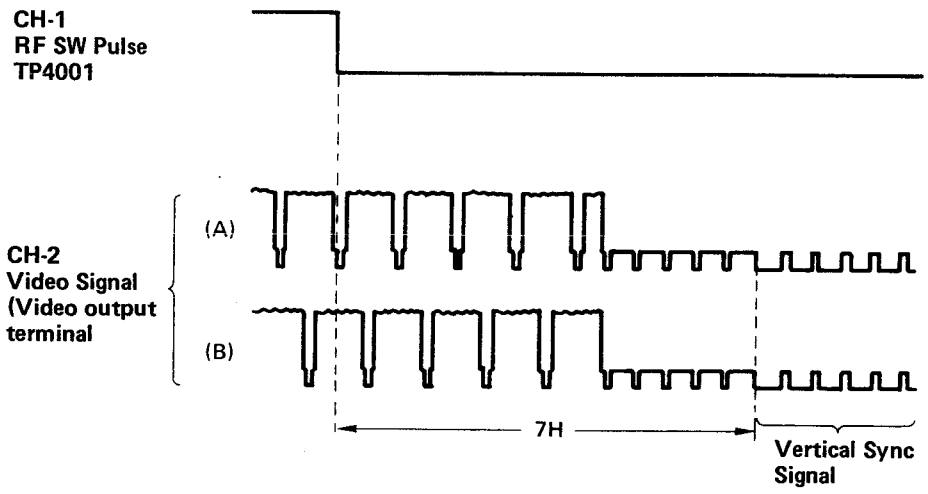


Fig. 4-2-5

9. FWD APC Lock Position (NTSC)

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR4005	TP4001 Video output terminal	7 ±0.5H Fig. 4-2-6	Oscilloscope	NTSC REC mode

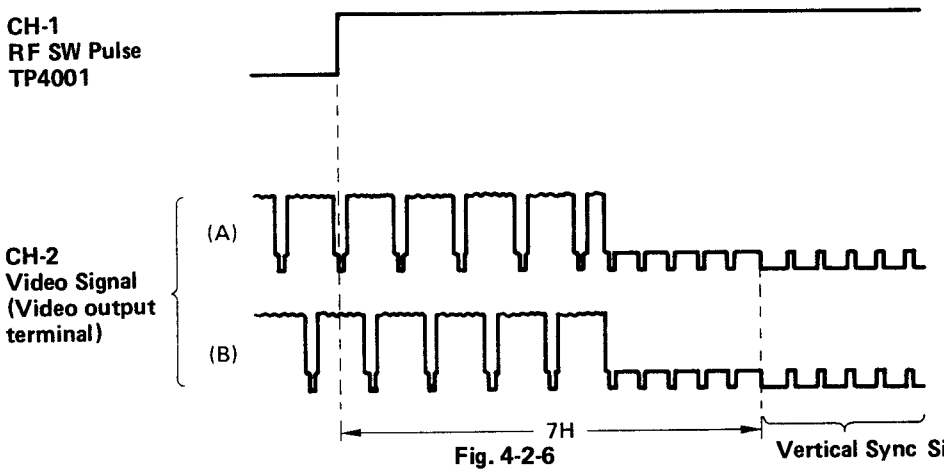


Fig. 4-2-6

10. FWD Search Lock (PAL/SECAM)

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR4013	TP4002	4.0 ±0.2V	VJ-0113 Oscilloscope	PAL F-SEARCH mode

11. FWD Search Lock (NTSC)

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR4009	TP4002	4.0 ±0.2V	VJ-0093 Oscilloscope	NTSC F-SEARCH mode

12. REV Search Lock (PAL/SECAM)

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR4014	TP4002	4.0 ±0.2V	VJ-0113 Oscilloscope	PAL R-SEARCH mode

13. REV Search Lock (NTSC)

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR4010	TP4002	4.0 ±0.2V	VJ-0093 Oscilloscope	NTSC R-SEARCH mode

14. FWD APC Lock (PAL/SECAM)

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR4403	TP4401	6.0 ±0.2	Oscilloscope	PAL or SECAM REC mode

15. FWD APC Lock (NTSC βII)

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR4407	TP4401	6.0 ±0.2	Oscilloscope	NTSC βII REC mode

16. FWD APC Lock Voltage (NTSC βIII)

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR4404	TP4401	6.0 ±0.2V	Oscilloscope	NTSC βIII REC mode

17. FWD Search Lock (PAL/SECAM)

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR4402	TP4401	6.0 ±0.2V	VJ-0113 Oscilloscope	PAL F-SEARCH mode

18. FWD Search Lock (NTSC)

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR4406	TP4401	6.0 ±0.2V	VJ-0093 (βIII) Oscilloscope	NTSC F-SEARCH mode

19. RVE Search Lock (PAL/SECAM)

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR4401	TP4401	6.0 ±0.2V	VJ-0113 Oscilloscope	PAL R-SEARCH mode

20. RVE Search Lock (NTSC)

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR4405	TP4401	6.0 ±0.2V	VJ-0093 (βIII) Oscilloscope	NTSC R-SEARCH mode

21. Tracking (PAL, SECAM)

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR4008	TP4001 TP4003	2.0 ±0.5ms Fig. 4-2-7	VJ-0113 Oscilloscope	PAL PLAY mode

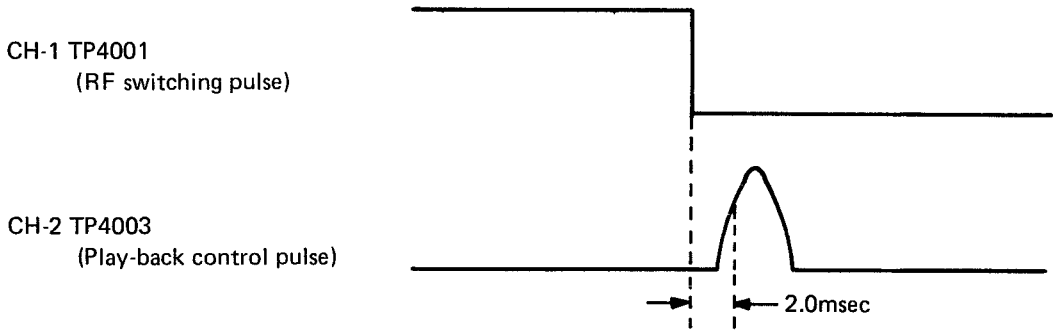


Fig. 4-2-7

22. Tracking (NTSC)

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR4007	TP4001 TP4003	0.5 ±0.5ms Fig. 4-2-8	VJ-0093 (βIII) Oscilloscope	NTSC PLAY mode

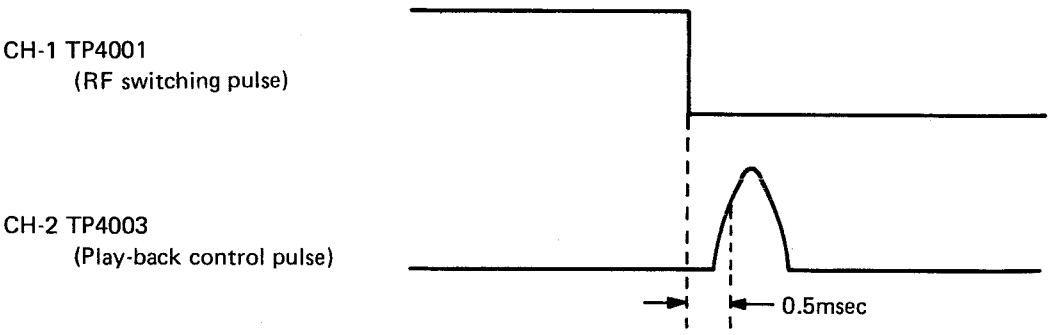
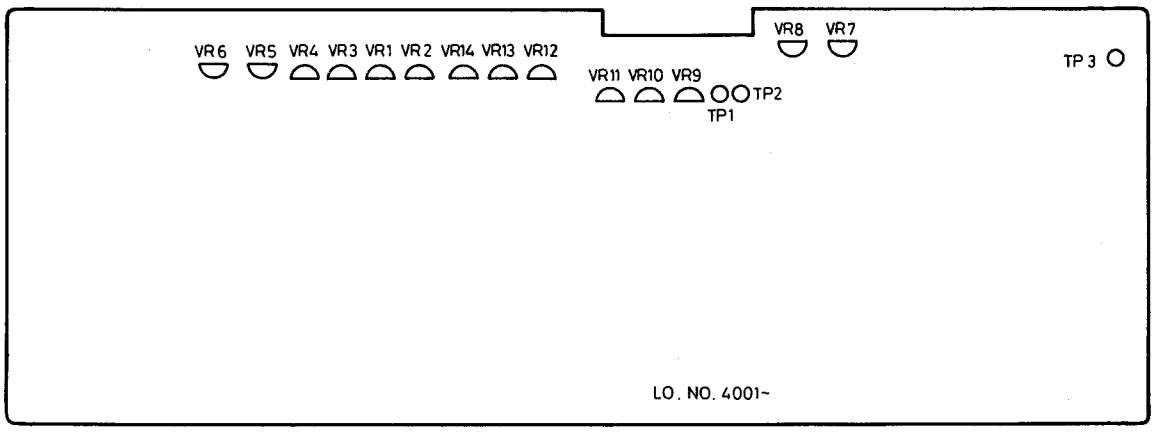
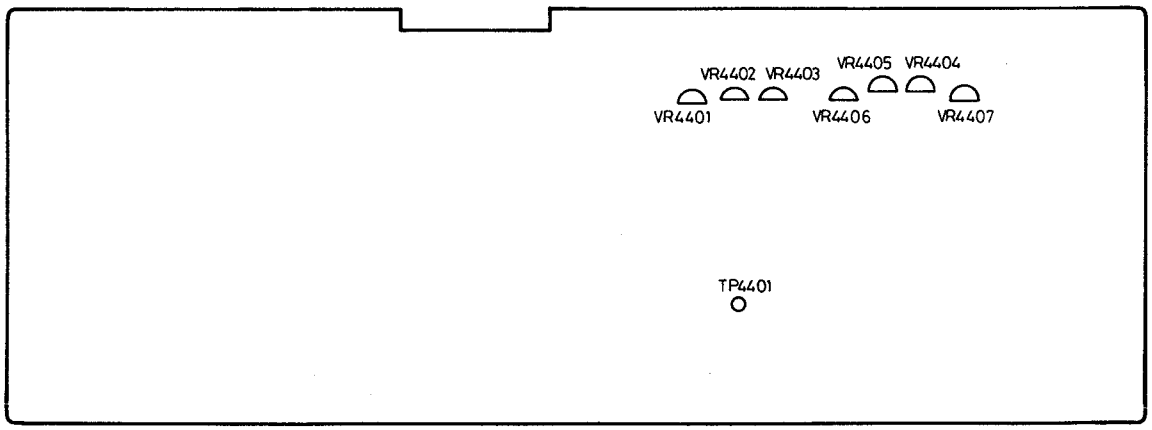


Fig. 4-2-8



SV-1



SV-2

Fig. 4-2-9

C. VIDEO PRE-AMP CIRCUIT

1. Preamplifier Frequency Response (PAL)

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR1503 (A0ch) VR1502 (B-ch)	Pin (3) of S1502	Fig. 4-3-1	VJ-0113 Oscilloscope	AUTO PLAY mode

NOTE: At this time, use pin (1) of S1502 (RF switching pulse) for the trigger pulse for waveform observation.

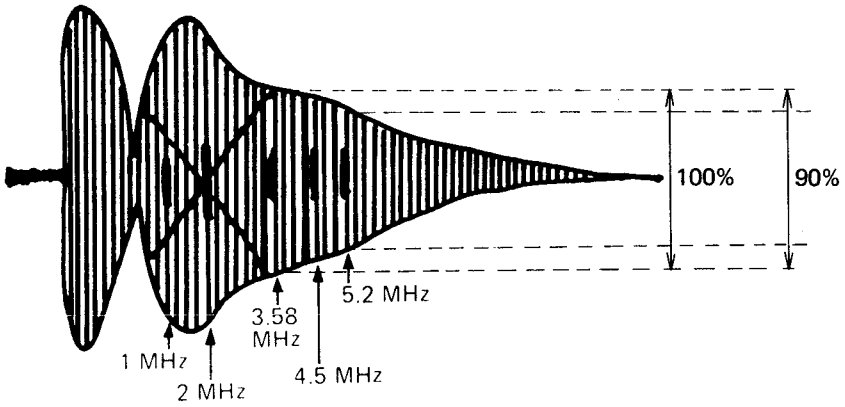


Fig. 4-3-1

2. Preamplifier Frequency Response (NTSC)

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR1506 CT1501 VR1507 CT1501	Pin (3) of S1502	Fig. 4-3-2	VJ-0096 Oscilloscope	NTSC PLAY mode

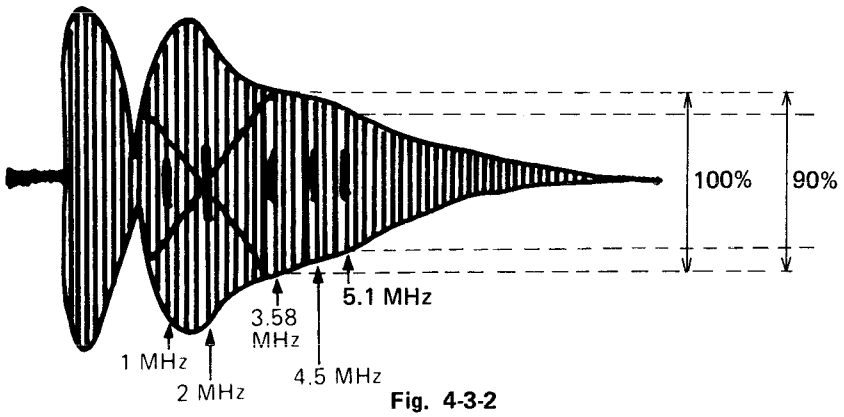


Fig. 4-3-2

3. Dropout Compensator Sensitivity

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR1501	TV screen	About one colour bar Fig. 4-3-3	VJ-0077	AUTO PLAY mode

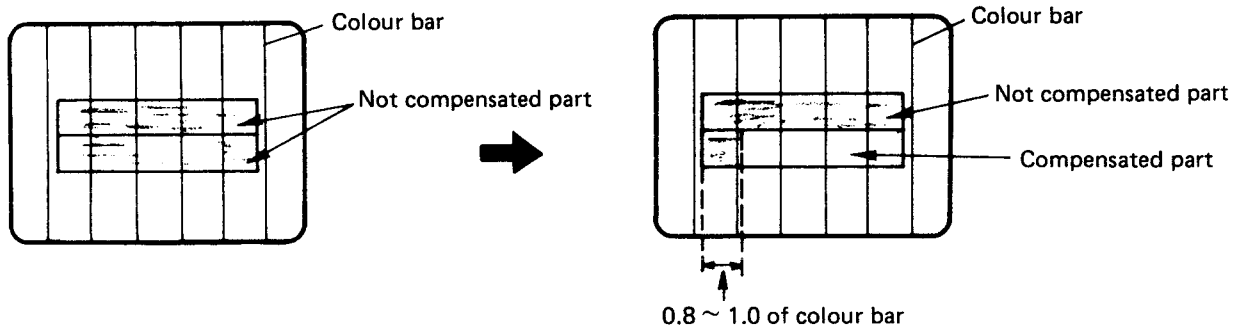


Fig. 4-3-3

4. Recording Amplifier Frequency Response

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR1504	TP1502 TP1501	Fig. 4-3-4	Colour-bar generator oscilloscope	AUTO REC mode

NOTE: Input a 100% white signal (PAL)

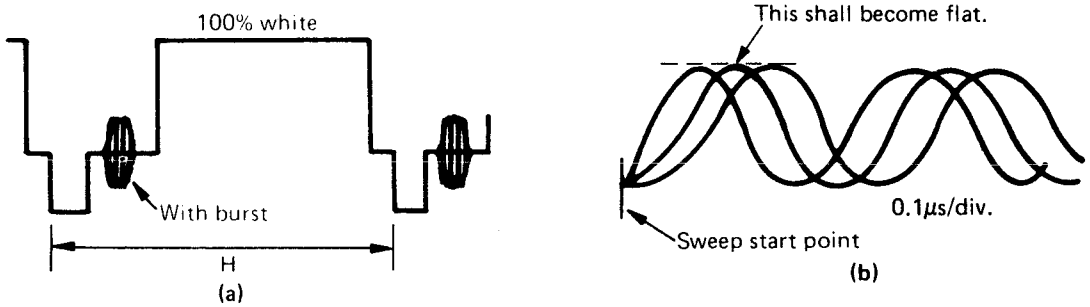


Fig. 4-3-4

5. Recording Current

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR1504	TP1502 TP1501	140 ±10mVp-p Fig. 4-3-5	Oscilloscope	AUTO REC mode

NOTE: Input a no signal

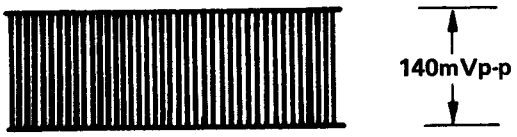


Fig. 4-3-5

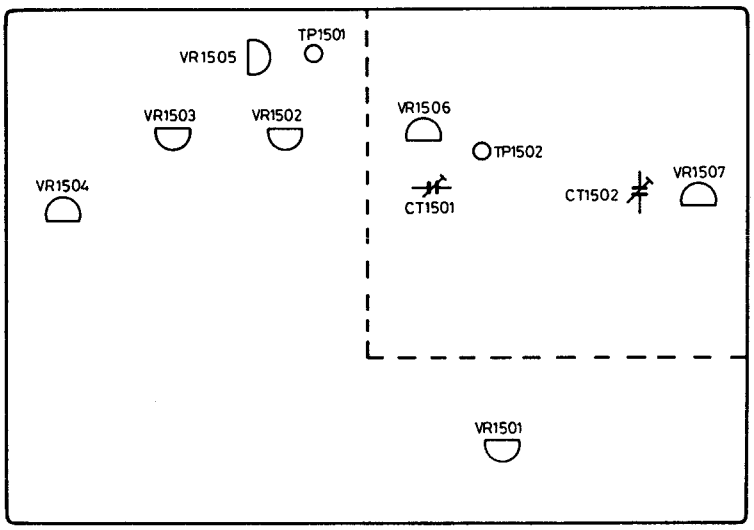


Fig. 4-3-6

D. VIDEO CIRCUIT (VD-1)

1. EE Level

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR1004	TP1013	2V ±0.1Vp-p Fig. 4-4-1	Colour-bar generator Oscilloscope	AUTO REC mode

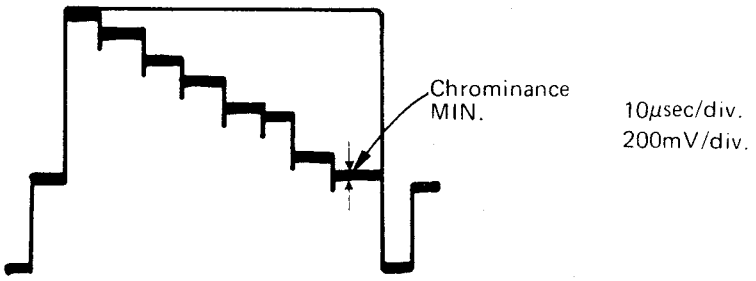


Fig. 4-4-1

2. Compressor

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR1005	TP1011	3.0V ±0.1V	Digital voltmeter	AUTO or PAL EE mode

3. Carrier Frequency Setting

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR1006	TP1001	3900 ±50 Hz	Frequency counter	AUTO EE mode

4. Deviation

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR1010	TP1001	2V ±0.1Vp-p	VJ-0113 Colour-bar generator Oscilloscope	AUTO EE mode

a. Load the alignment cassette and playback the colour-bar signal.

b. Connect the oscilloscope to TP1001.

c. Playback level confirm so that is 2.0 ±0.1Vp-p.

d. Input a colour-bar signal which contains a 100% white signal.
It is recording and playback.

e. Adjust VR1008 so that is 2.0 ±0.1Vp-p.
At this time, open the video output terminal.

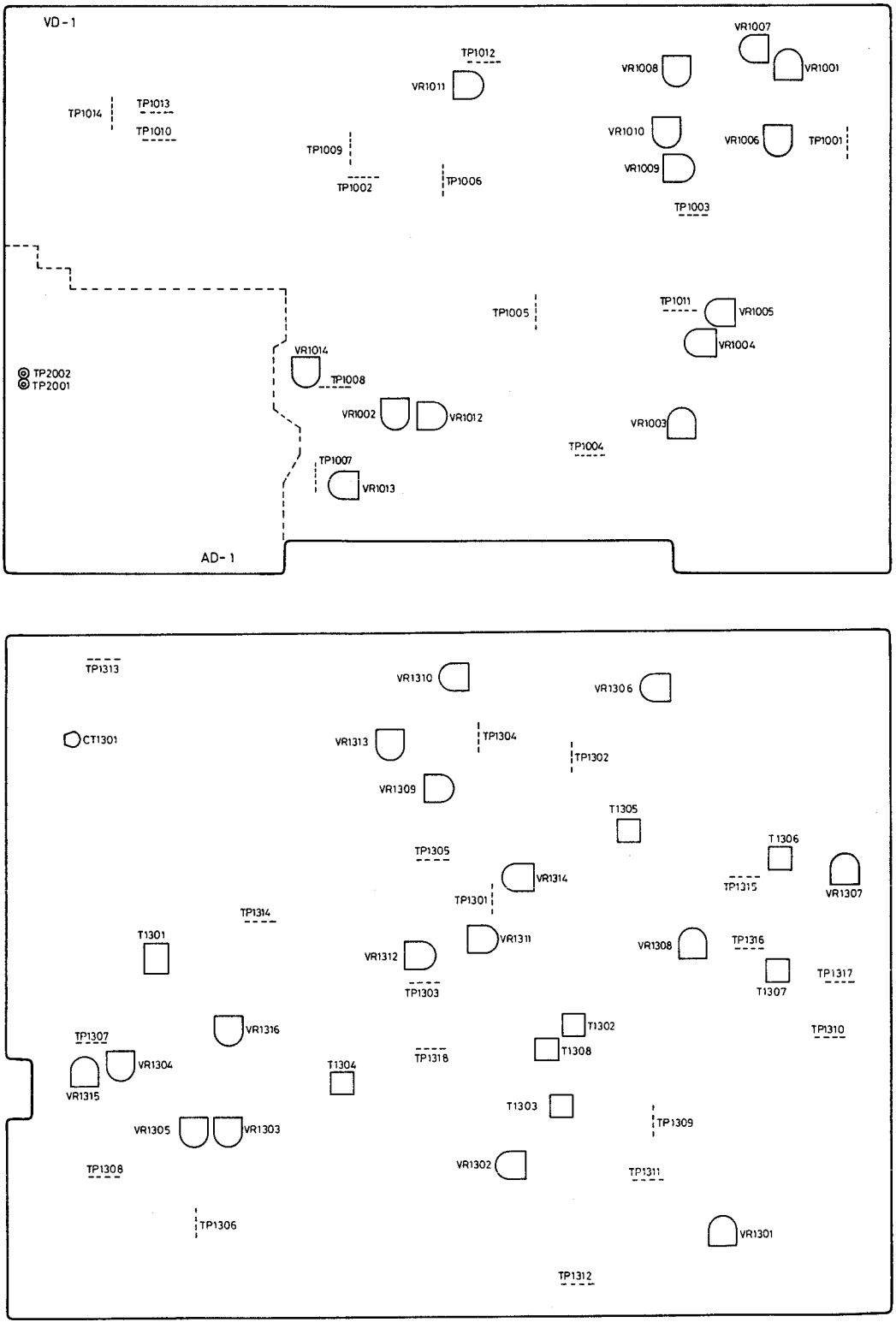

VD-1
TP1012
VR1007
VR1008
VR1001
VR1011
TP1013
TP1014
TP1010
TP1009
VR1010
VR1006
TP1001
VR1009
TP1002
TP1006
TP1003
TP1005
TP1011
VR1005
VR1004
VR1014
TP2002
TP2001
TP1008
VR1002
VR1012
VR1003
TP1004
TP1007
VR1013
AD-1
TP1313
VR1310
VR1306
CT1301
VR1313
TP1304
TP1302
VR1309
T1305
TP1305
T1306
VR1314
TP1315
VR1307
TP1301
TP1314
T1301
VR1311
VR1308
TP1316
VR1312
TP1303
T1307
TP1317
VR1316
T1302
TP1310
TP1307
TP1318
T1308
VR1304
T1304
VR1315
T1303
TP1309
VR1305
VR1303
VR1302
TP1311
TP1308
TP1306
VR1301
TP1312

Fig. 4-4-2

5. White Clip and Dark Clip

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR1007 VR1001	TP1003	Fig. 4-4-3	Oscilloscope Colour-bar generator	PAL EE mode

a. Adjust VR1007 so that, supposing that the interval between the sync tip and the white peak is 100%, the interval between the sync tip and the white overshoot becomes 210 ±10%.

b. Adjust VR1006 so that the interval the sync tip and the dark overshooting becomes 65 ±5%.

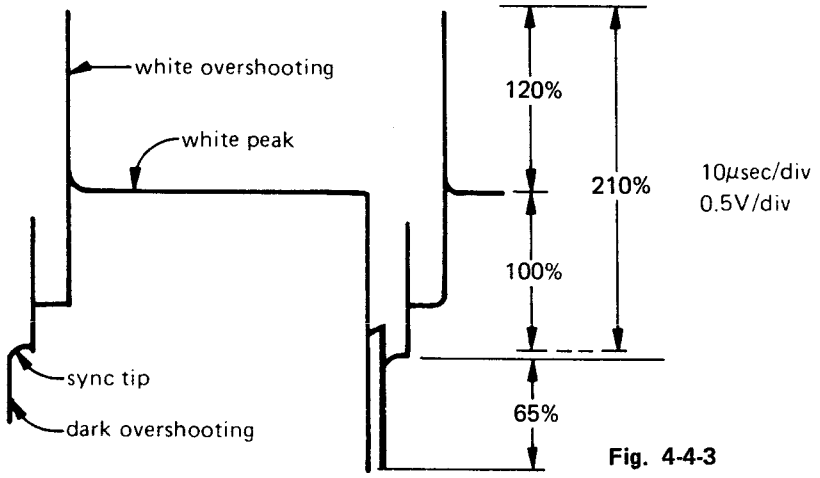


Fig. 4-4-3

6. White Clip

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR1011	TP1012	0.8 ±0.1V	Digital voltmeter	NTSC 3.58 EE mode

7. Carrier Frequency Setting

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR1008	TP1001	3650 ±50KHz	Frequency counter	NTSC 3.58 EE mode

8. Deviation (NTSC)

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR1009	TP1001	1V ±0.05Vp-p	Colour bar generator, Oscilloscope	NTSC 3.58 EE mode

a. Connect the colour bar generator to the VIDEO IN jack of VCR, and record the colour bar signal.
b. After connecting the osciloscope to TP1001, playback and measure the luminance signal level.
c. Adjust VR1009 so that the luminance signal level is equal to 1.00 ±0.05 Vp-p.

9. Y system Comb Noise Canceller

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR1003	TP1004	Fig. 4-4-4	VJ-0113 Oscilloscope	AUTO PLAY mode

Adjust VR1003 so that the video signal is cancelled and only the noise component remains.

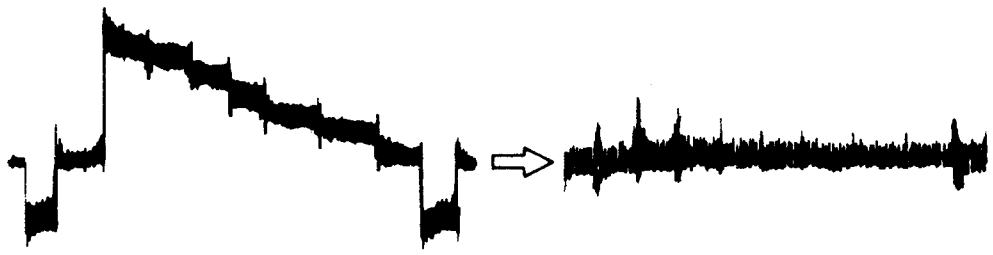


Fig. 4-4-4

10. Playback Level (NTSC 3.58MHz)

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR1014	TP1013	1.0 ±0.05Vp-p	VJ-0096 Oscilloscope	NTSC 3.58 PLAY mode

11. Playback Level (NTSC 4.43MHz)

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR1002	TP1013	1.0 ±0.05Vp-p	JV-0096 Oscilloscope	NTSC 4.43 PLAY mode

12. Expander

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR1013	TP1007	1.0 ±0.05V	Oscilloscope	PAL PLAY mode

13. Playback Level (PAL)

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR1012	TP1013	1.0 ±0.05V	Oscilloscope	PAL PLAY mode

14. TEST signal

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
–	TP1010 or TV Screen	Fig. 4-4-5	Oscilloscope or TV	TEST SW ON EE mode

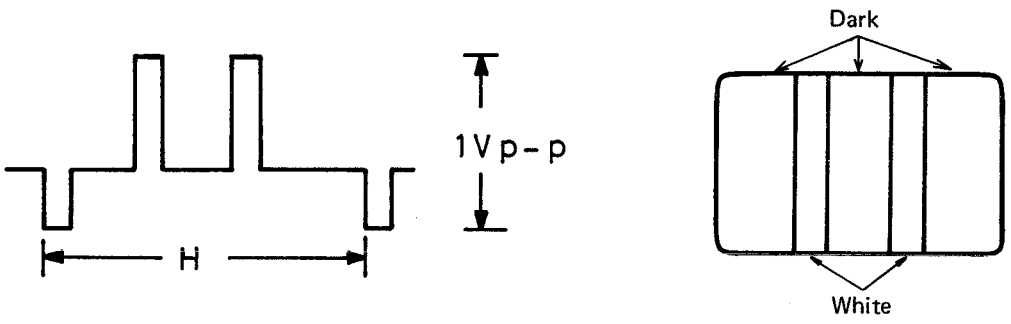


Fig. 4-4-5

VD-2

1. ACC

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR1301	TP1311	800mV ±30mVp-p	Colour-bar generator Oscilloscope	PAL EE mode

2.

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VC1301	TP1313	4.433619MHz ±5Hz	Frequency counter	PAL EE mode

3. AFC

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR1305	TP1306	1.4 ±0.05V	Oscilloscope Colour-bar generator	PAL EE mode

4.

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR1313	TP1308	The carrier leak is minimized.	Oscilloscope Colour-bar generator	AUTO or PAL EE mode

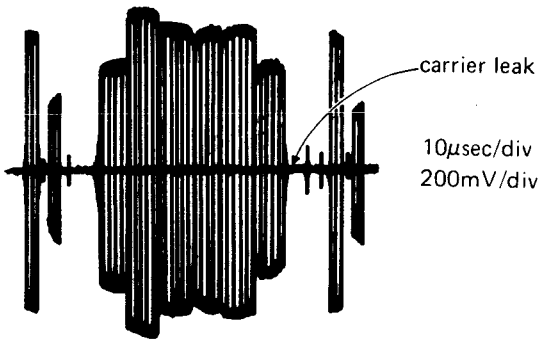


Fig. 4-4-6

5. Pilot Burst Level

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR1302	TP1308	The same level as chrominance signal	Oscilloscope Colour-bar generator	PAL EE mode
Adjust VR1302 until the burst signal of TP1308 wave formation is the same level as chrominance signal.				

6. REC Current

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR1315	TP1307	$0.35^{+0}_{-0.05}$Vp-p	Colour-bar signal Oscilloscope	PAL REC mode

7. 4.43MHz Comb Filter

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR1308 T1305	TP1321	Minimum	Frequency oscillator Frequency counter Oscilloscope	PAL PLAY mode
INPUT: TP1316 4429.713kHz 0.5Vp-p				

8. 1H Balance

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR1306	TP1322	Minimum	Frequency oscillator Frequency counter Oscilloscope	PAL EE mode
INPUT: TP1316 4425.752kHz 0.5Vp-p				

9. 3.58MHz Comb Filter

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR1307 T1306	TP1323	Minimum	Frequency oscillator Frequency counter Oscilloscope	PAL EE mode
INPUT: TP1317 3571.678kHz 0.5Vp-p				

10. SP-AFC

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR1309	TP1305	15.625 ±50Hz	Frequency counter	PAL EE mode

11. 1H Delay in Palyback Variations

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
T1304 VR1312	TP1302 TP1303	smallest value	Frequency oscillator Oscilloscope Frequency counter	PAL EE mode

INPUT: TP1318 4425.752kHz 0.1Vp-p

a. Connect channel 1 of the oscilloscope to TP1302.

b. Connect channel 2 of the oscilloscope to TP1303.

c. Adjust T1304 and VR1312 so that the chrominance signal level decreases to the smallest value.

12. Reinsertion burst width

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR1311	TP1301	4 ±0.5μs	Colour bar generator, Oscilloscope,	PAL EE mode

NOTE: Input the colour bar signal and set pin (1) of S1002 to "HIGH".

13. Amplitude of the Re-inserted Burst Signal

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR1310	TP1301	90 ±10%	Oscilloscope Colour-bar generator	PAL EE

As in the previous section, as playback variations switch between HIGH and LOW, adjust VR1310 until the re-inserted burst wave formation is the 90 ±10% level as the true burst.

14. Burst Phase Detection Range

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR1314	–	–	VJ-0113	PAL PLAY mode

a. Watch the playback image during PICTURE SEARCH, and adjust VR1314 until the colour is normal and there is no colour skip in sections outside of the noise bars.

b. Set the control to the middle position between the normal limits.

15. AFC Offset

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR1304	TP1306	No level difference	VJ-0113 (colour-bar) Oscilloscope	PAL PLAY mode
Use VR1010 to adjust the waveform so that there is no level difference.				

16. Bell Filter

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
T1307	TP1315	Flat	Oscilloscope Colour-bar generator	SECAM EE mode

17. 7.8kHz TUNE

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
T1301	TP1314	Maximum	Oscilloscope Colour-bar generator	SECAM EE mode

18. SECAM Detection Sencitivity

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR1316	TP1328	230mV ±10mV	Oscilloscope Colour-bar generator	SCAM EE mode

19. PB-BPF

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
T1303	TP1324	Fig. 4-4-7	Oscilloscope Sweep-marker generator	SECAM EE mode

INPUT TP1318

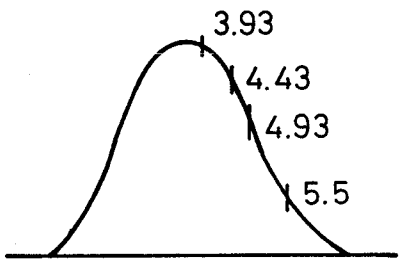


Fig. 4-4-7

20. Reverse Bell Filter

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
T1302	TP1325	Fig. 4-4-8	Oscilloscope Sweep-marker generator	SECAM EE mode

INPUT: TP1318

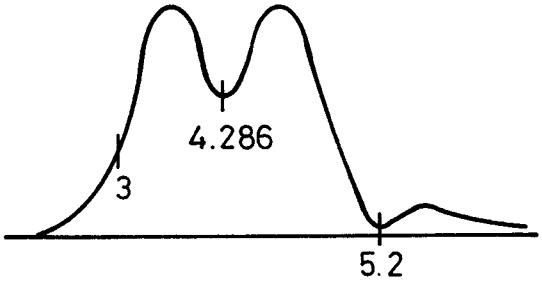


Fig. 4-4-8

E. AUDIO CIRCUIT

1. Bias Current and OSC Frequency

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR2004	TP3801 TP3802	17mV (170μA) (70kHz ±5kHz confirmation)	Vacuum-tube voltmeter Frequency counter	with no signal

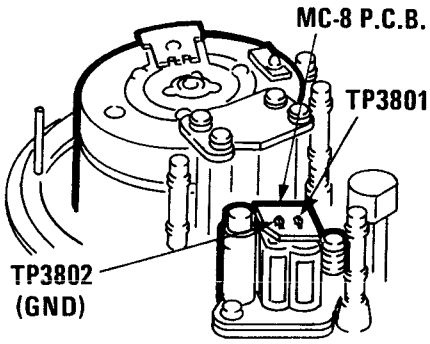


Fig. 4-5-1

2. Recording Current

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
Confirmation	TP3801 TP3802	3.2mV ±0.5mV (32μA ±5μA)	Vacuum-tube voltmeter	REC mode NTSC βII mode
Short circuit base of TP2001 and TP2002 of the VD-1 circuit board so that oscillation is stopped.				

3. Playback Equalizer and Overall Frequency Response (NTSC βII)

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR2001	AUDIO LINE OUT	Fig. 4-5-2	Oscilloscope Audio frequency oscillate	REC/PLAY NTSC βII mode

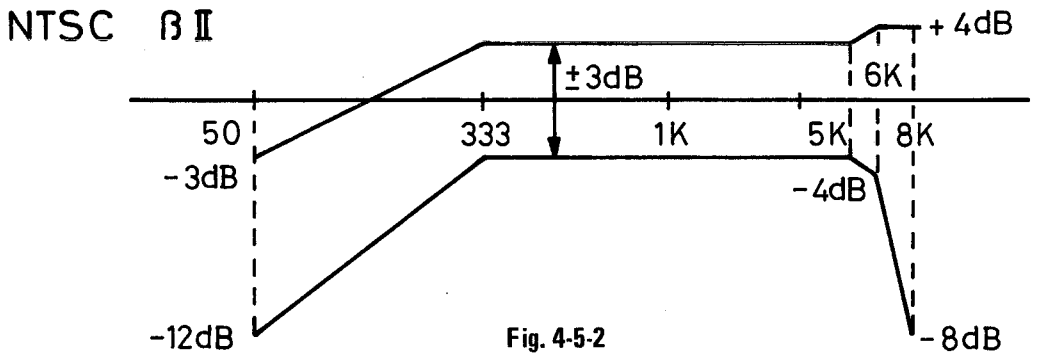


Fig. 4-5-2

4. **Overall Frequency Response (NTSC βIII)**

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
Confirmation	AUDIO LINE OUT	Fig. 4-5-3	Oscilloscope Audio frequency oscillate	NTSC βIII mode REC/PLAY

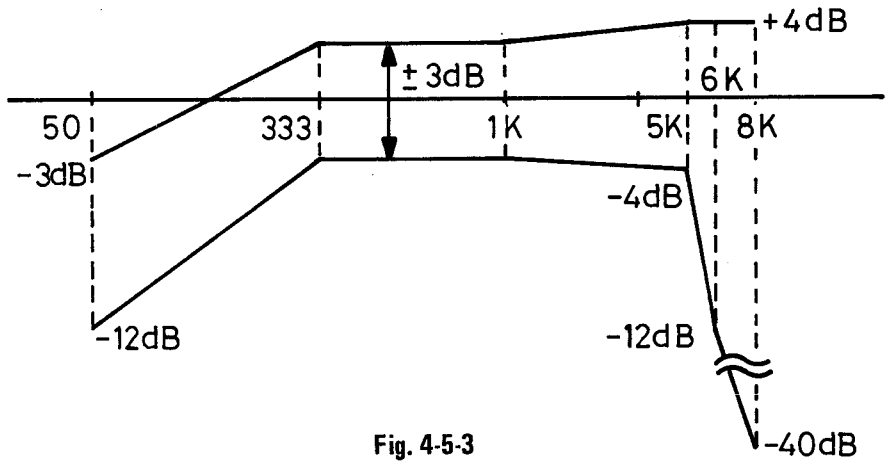


Fig. 4-5-3

5. **Overall Frequency Respons (PAL/SECAM)**

Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
Confirmation	AUDIO LINE OUT	Fig. 4-5-4	Oscilloscope Audio frequency oscillatte	PAL or SECAM REC/PLAY mode

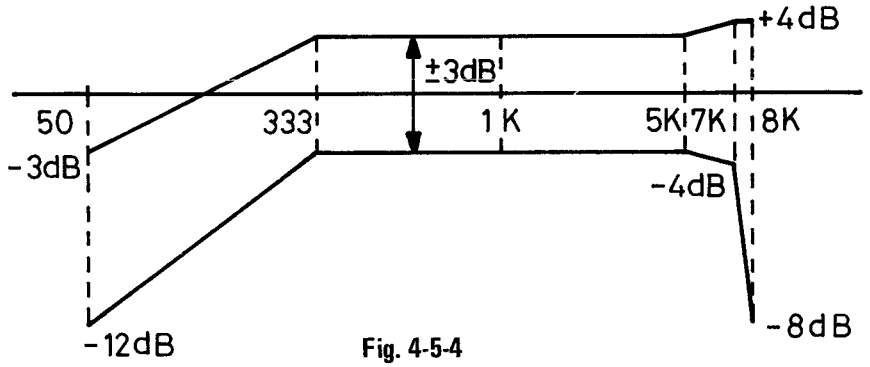


Fig. 4-5-4

6. **OUT PUT Level**

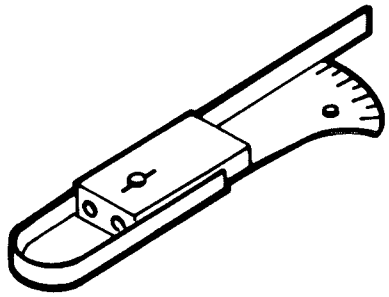
Adjustment location	Measurement point	Adjustment result	Measurement equipment	Adjustment condition
VR2002	AUDIO LINE OUT	−5dBs	Audio frequency oscillate VTVM	NTSC βII REC/PLAY mode

V. MECHANISM ADJUSTMENTS

A. JIGS AND TOOLS FOR ADJUSTMENT

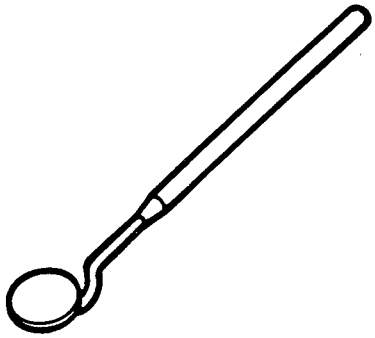
No.	Names	Jig. No.	Remarks
1	Spring tension gauge (100 gram)	VJ-0012	Measurement for FWD (PLAY), R-SEARCH take-up torque
2	Spring tension gauge (500 gram)	VJ-0014	Measurement for F FWD, REW take-up torque
3	Inspection mirror	VJ-0015	Tape path alignment
4	Eccentric screwdriver	VJ-0017	Tape path alignment
5	Hexagonal wrench (M3)	VJ-0022	Adjustment of back tension guide
6	Tension gauge for reel	VJ-0038	Measurement for all winding torque
7	Alignment tape	VJ-0093 VJ-0113	Tape path alignment
8	Cassette stand plate gauge	VJ-0105	Adjustment of reel height
9	Hexagonal wrench (M2.6)	VJ-0108	Installation of reel motor pulley
10	Grip ring pincher	VJ-0128	For attaching/detaching grip ring
11	Position adjustment gauge	VJ-0120	Adjustment of back tension guide
12	Checker adjustment gauge	VJ-0121	Adjustment of back tension guide
13	Grip ring pincher head	VJ-0128-1	Spare head of grip ring pincher VJ-0128

VJ-0012
VJ-0014



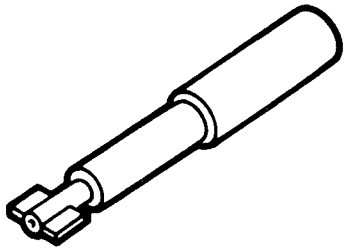
No. 1, No. 2

VJ-0015



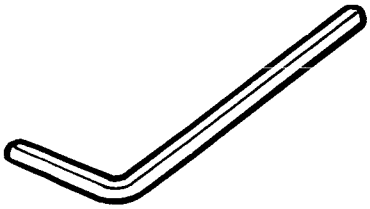
No. 3

VJ-0017



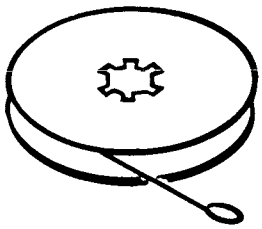
No. 4

VJ-0022



No. 5

VJ-0038



No. 6

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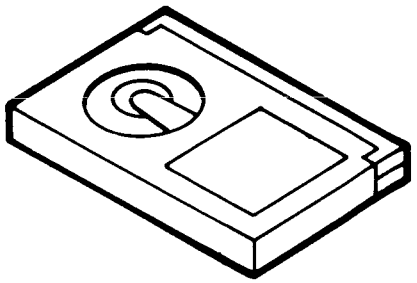
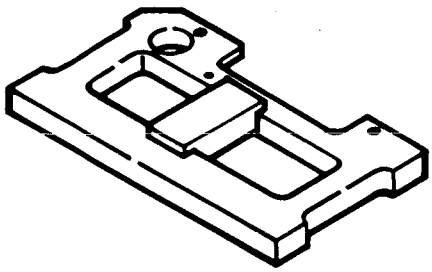


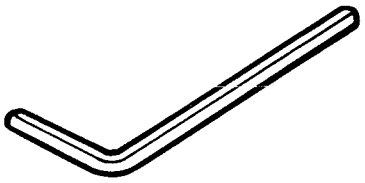
No. 7

VJ-0105



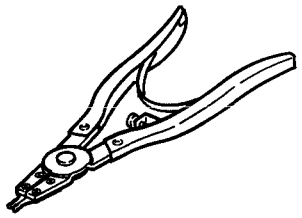
No. 8

VJ-0108



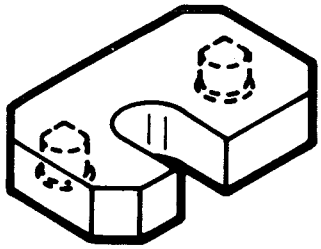
No. 9

VJ-0128



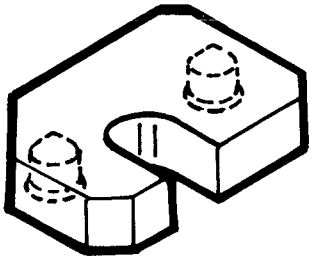
No. 10

VJ-0120



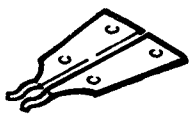
No. 11

VJ-0121



No. 12

VJ-0128-1



No. 13

B. PREPARATIONS FOR ADJUSTMENTS

1. REMOVAL OF THE CASSETTE COVER

Remove the cassette cover as explained in section IV. CABINET DISASSEMBLY.

2. REMOVAL OF THE VEIL (See Fig. 5-2-2.)

Remove the veil by removing the screw (a).

3. REMOVAL OF THE CASSETTE HOLDER (See Fig. 7-2-2.)

(1) Detach the E-rings from the left and right cassette holder links and disconnect the links from the cassette holder.

(2) Remove the spring which is attached to the cassette holder and the right link.

(3) Bring the cassette holder down in the direction of arrow A, and separate the groove in the cassette holder from the left-to-right clearance adjusting screw.

(4) Slide the cassette holder to the left, and detach the cassette holder shaft from the right cassette stand.

(5) Slant the cassette holder to the right, detach the cassette holder shaft from the left cassette stand, and remove the cassette holder.

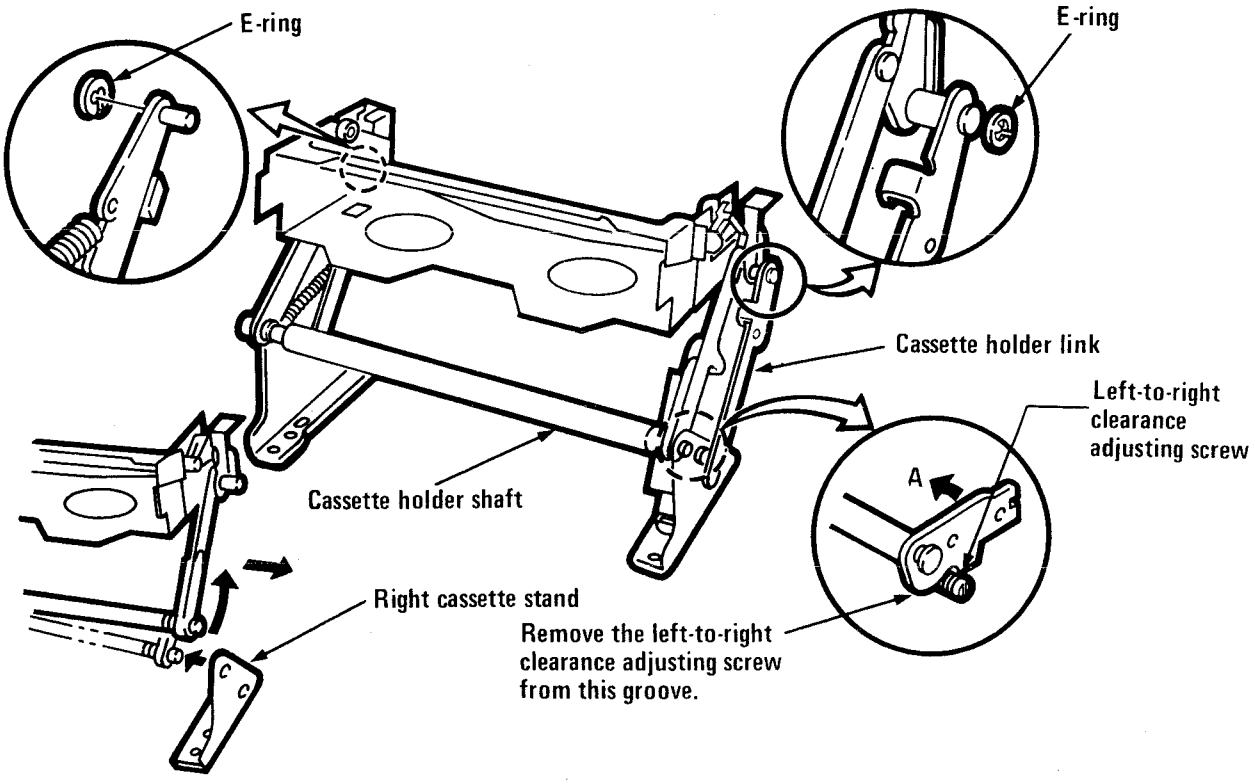


Fig. 5-2-2

[Notes regarding installation] (See Fig. 5-2-3.)

Installation can be done by carrying out items 1 ~ 3 of the removal procedure in reverse order; however, note the following:

(1) Be sure that the groove in the cassette holder is firmly seated on the left-to-right clearance adjusting screw. (See Fig. 5-2-3.)

(2) Do not loosen the left-to-right clearance adjusting screw or the securing screws of the right cassette holder link.

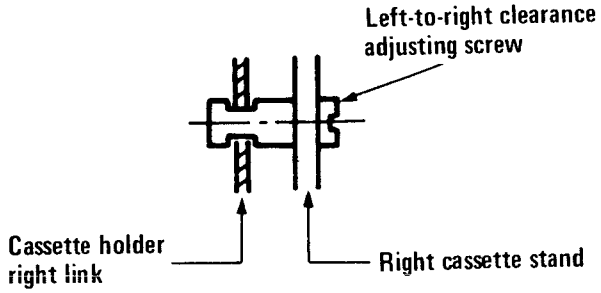


Fig. 5-2-3

4. OPERATION OF THE VCR ONCE THE CASSETTE HOLDER HAS BEEN REMOVED (See Figs. 5-2-4, 5-2-5.)

(1) Turn on the power.

(2) While pressing the cassette holder lock lever in the direction of arrow A, press the cassette detection slide in the direction of arrow B.

(3) The mode will change in accordance with the operation button which is pressed.

(4) In both the REW and R-SEARCH modes, the safety mechanism will function if the take-up reel base does not rotate, therefore, manually rotate the take-up reel base clockwise (direction C). (See Fig. 5-2-5.)

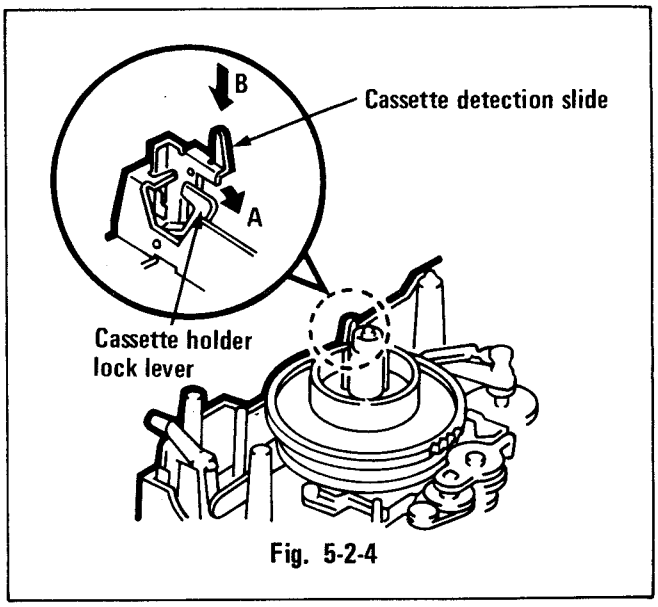


Fig. 5-2-4

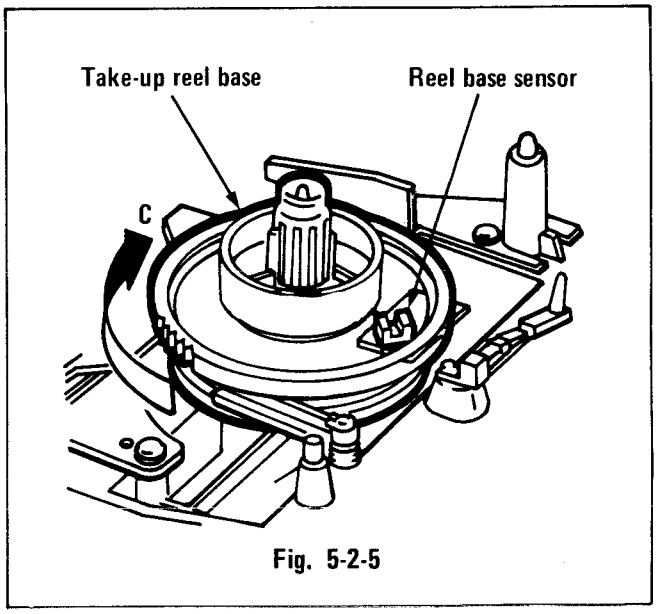


Fig. 5-2-5

[Manual rotation of the loading ring] (See Figs. 5-2-6, 5-2-7, 7-2-8.)

(1) To load, manually rotate the loading motor pulley in the direction of arrow D, and the loading ring will rotate counter clockwise.

(2) At the completion of the loading condition, the loading ring stopper will function to stop the loading ring rotation. (See Fig. 5-2-7.)

(3) To unload, manually rotate the loading motor pulley in the direction of arrow E, and the loading ring will rotate clockwise.

(4) At the completion of the unloading condition, the loading ring stopper will function to stop the loading ring rotation. (See Fig. 5-2-8.)

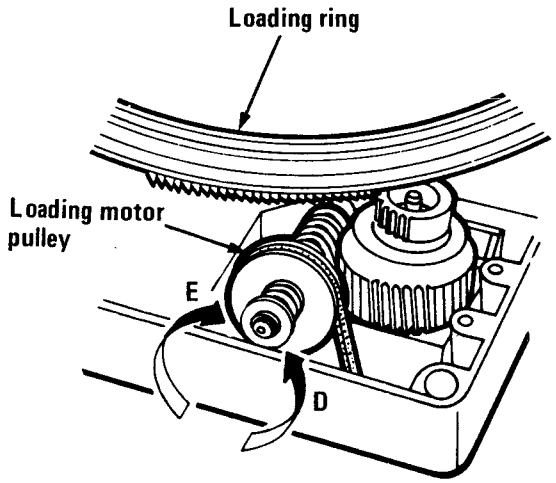


Fig. 5-2-6

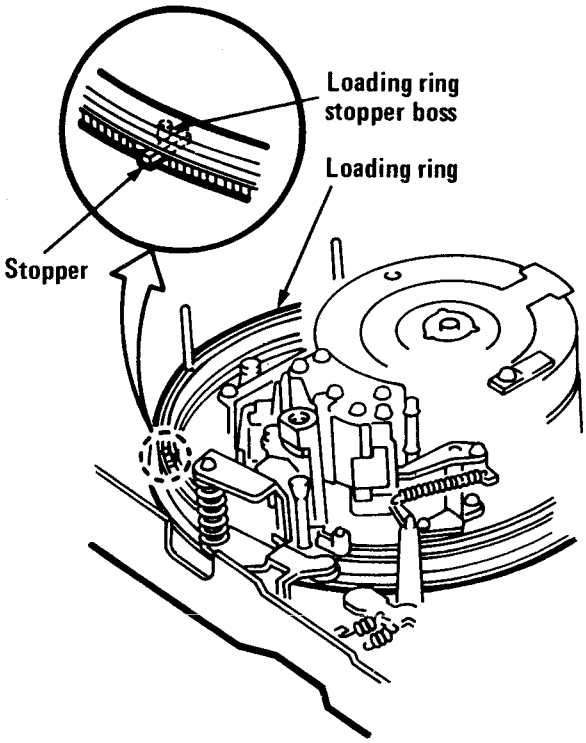


Fig. 5-2-7

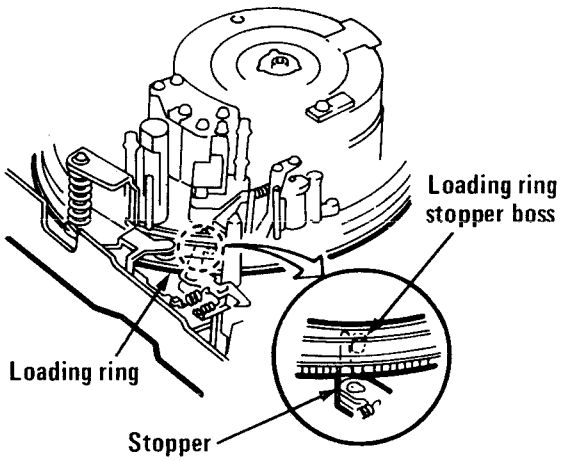


Fig. 5-2-8

C. MAINTENANCE TIMETABLE

Parts \ Time (Hours)	500	1000	1500	2000	2500	3000	3500	4000	5000
Video head	△	△	△	△	△	△	△	△	△
Audio/control head	△	△	△	△	△	△	△	△	△
Pinch roller	△	△	△	△	△	△	△	△	△
Full erase head	△	△	△	△	△	△	△	△	△
Supply reel base				▲				▲	
Take-up reel base				▲				▲	
PLAY gear		▲		▲		▲		▲	
F FWD/REW roller		▲		▲		▲		▲	
Center gear		▲		▲		▲		▲	

△ Cleaning . . . . . methyl alcohol
▲ Lubrication . . . . specified lubricant

D. MECHANISM REPAIR AND PARTS REPLACEMENT

Before replacing any of the following parts, be sure to turn off the power [set the power switch to the "STAND BY" position or pull out the power cord from the outlet.]

* Video head drum
* Video head
* Audio/control head
* Full-erase head
* Micro switches (cassette-in, loading end SW, Unloading end SW prevention, Cassette insert SW, Front end SW)
* Reel motor
* Capstan motor
* Loading motor
* Front loading motor
* Tape end sensors (FWD, REW)
* DEW sensor
* Reel base sensor

(Caution)

Be especially sure that the power is off [the power switch is in the "STAND BY" position] when connecting or disconnecting the connectors of the video head drum and of the capstan motor. If one of these connectors is connected or disconnected while the power is on [the power switch is in the "ON" position] the internal ICs will be damaged.

1. VIDEO HEAD (See Fig. 5-4-1.)

(1) Turn off the power. [Set the power switch to the "STAND BY" position.]

(2) Move the video head drum to a position at which the video heads are easy to clean.

(3) Wipe each head several times with the deerskin part of the head cleaning stick. If the heads are extremely dirty, wipe more times.

(Note)

Note that the two video heads are located directly opposite each other on the video head drum.

(Caution)

* When pressing a finger on the head cleaning stick to clean the heads, do not press too hard.
* Do not move the head cleaning stick up and down against the video heads; doing so will damage the heads.

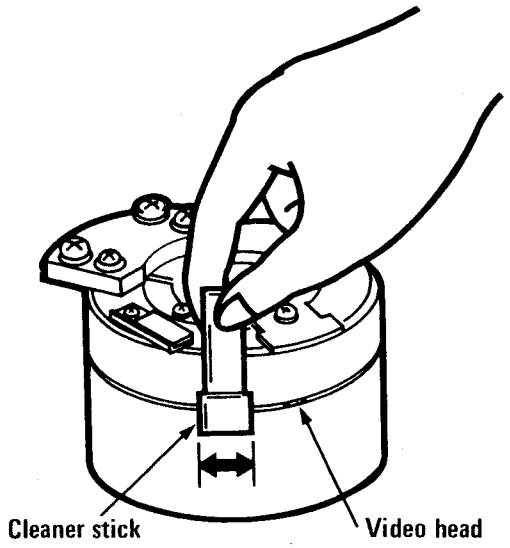


Fig. 5-4-1

2. CLEANING THE AUDIO/CONTROL HEAD AND FULL-ERASE HEAD (See Figs. 7-4-2, 7-4-3.)

Apply alcohol to the cleaning stick, and move the cleaning stick against the heads in the direction of the head gap.

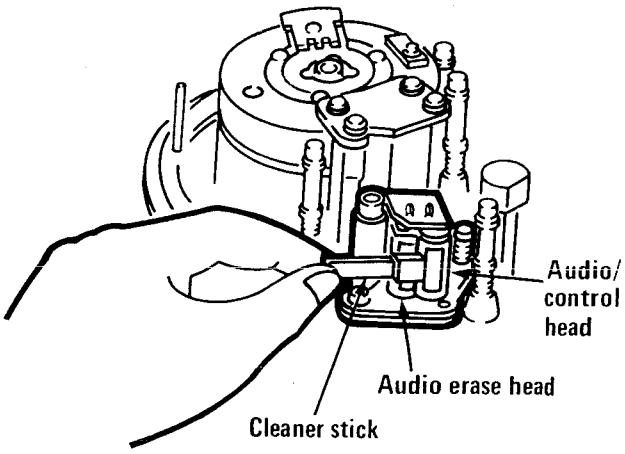


Fig. 5-4-2

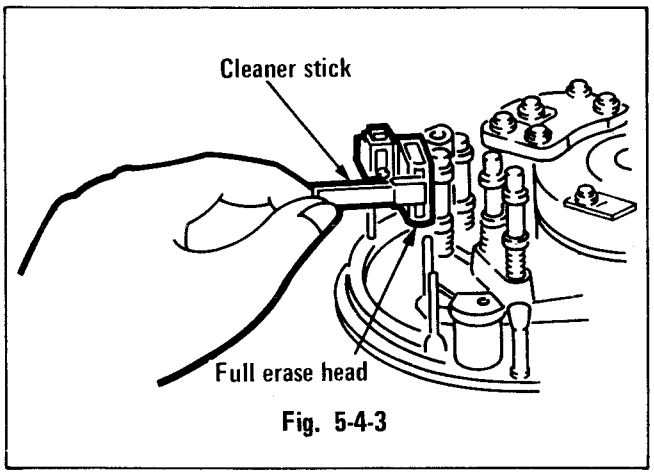


Fig. 5-4-3

3. PINCH ROLLER (See Fig. 5-4-4.)

(1) Using a soft cloth moistened with alcohol, clean the surfaces of the pinch roller.

(2) If there are scratches on the pinch roller, remove the E-ring and replace the pinch roller lever assembly.

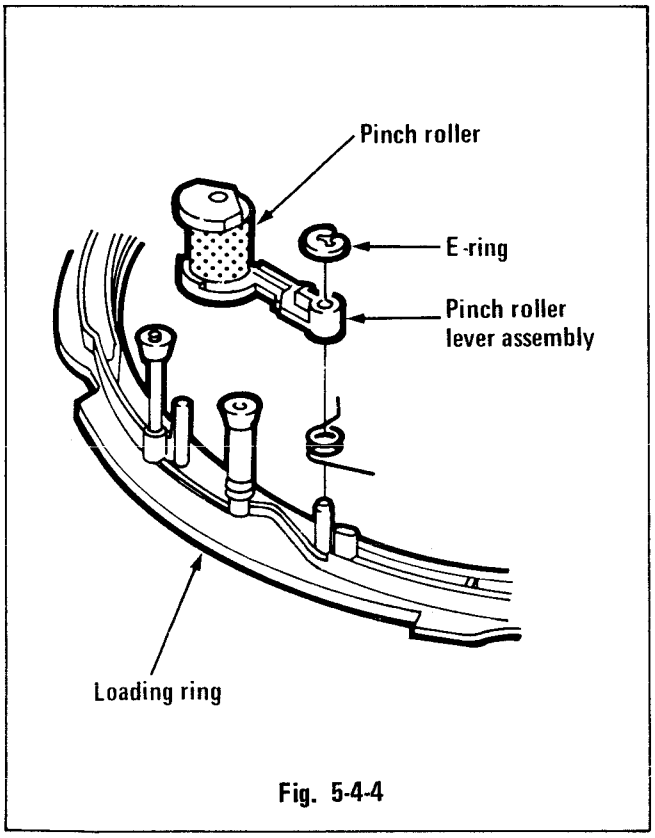


Fig. 5-4-4

4. TAPE PATH

Clean the surfaces of the tape guides and the drum tape path by using a soft cloth or cleaning stick moistened with a alcohol.

(Caution)

When cleaning the drum surfaces, be careful not to contact the video heads.

5. SUPPLY REEL BASE (See Fig. 5-4-5.)

(1) Remove the FL mecha. Assy.. (Refer to item **"B. PREPARATIONS FOR ADJUSTMENT".**)

(2) Remove the washers holding the supply reel base.

(3) Turn the ratchet brake in the direction of arrow A.

(4) While pressing the mode select slide in the direction of arrow B, remove the supply reel base and pulley.

(Caution)

Be careful not to lose the height adjustment spacer.

(5) Wipe off the old oil from the reel shaft by using a cloth moistened with alcohol, and then apply a small amount of new oil.

(6) While pressing the mode select slide in the direction of arrow B, install the supply reel base, and pulley. If a new supply reel base is being installed, adjust the reel base hight. (Refer to item **"E. ADJUSTMENTS, 1. REEL BASE HIGHT".**)

(7) Mount the washers, and then install the FL mecha. Assy..

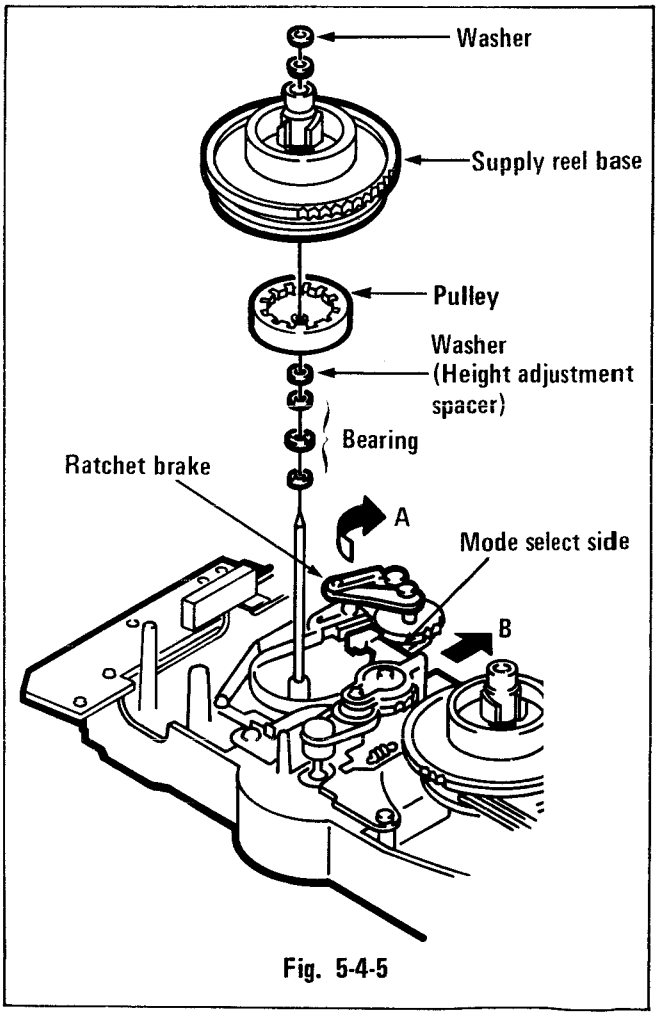


Fig. 5-4-5

6. TAKE-UP REEL BASE (See Fig. 5-4-6.)

(1) Remove the FL mecha. Assy.. (Refer to item "B. PREPARATIONS FOR ADJUSTMENT".)

(2) Remove the washers holding the take-up reel base.

(3) While pressing the mode select slide in the direction of arrow A and the take-up reel soft brake in the direction of arrow B, remove the take-up reel base.

(Caution)

Be careful not to lose the height adjustment spacer.

(4) Wipe off the old oil from the reel shaft by using a cloth moistened with alcohol, and then apply a small amount of new oil.

(5) While pressing the mode select slide in the direction of arrow A and the take-up reel soft brake in the direction of arrow B, install the take-up reel base. If a new take-up reel base is being installed, adjust the reel base height. (Refer to item "E. ADJUSTMENTS, 1. REEL BASE HEIGHT".)

(6) Mount the washers, and then install the FL mecha. Assy..

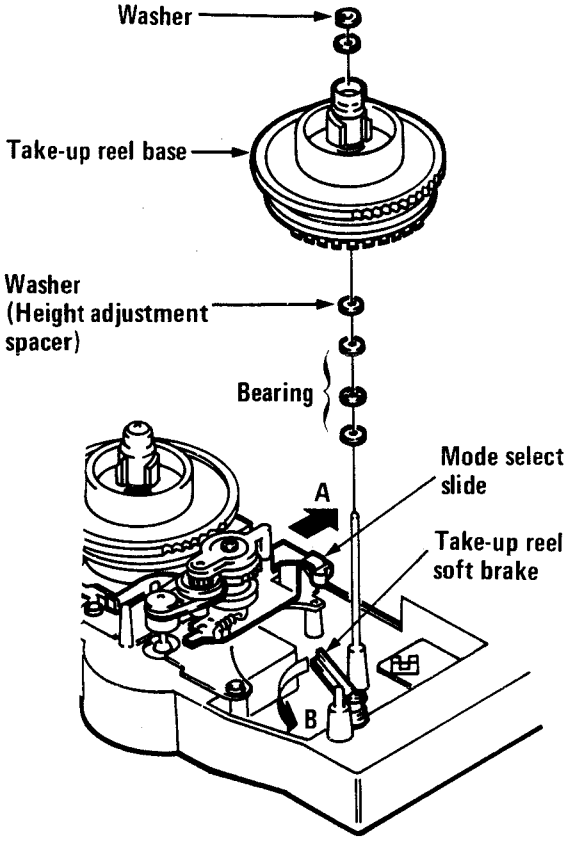


Fig. 5-4-6

7. REEL BASE DRIVE GEAR ASSEMBLY (See Fig. 5-4-7.)

(1) Remove the FL mecha. Assy.. (Refer to item "B. PREPARATIONS FOR ADJUSTMENT".)

(2) Remove the supply reel base. (Refer to item "5. SUPPLY REEL BASE".)

(3) Remove the take-up reel base. (Refer to item "6. TAKE-UP REEL BASE".)

(4) Remove the screw (a) which secures the ratchet brake, and then remove the brake.

(5) Remove the reel motor belt.

(6) Remove the screws (b) which secure the reel base drive gear assembly, and then remove the assembly.

(7) Remove the E-ring, and then remove the center gear and the F FWD/REW lever. Next, remove the washers, and then remove the play gear and the F FWD/REW roller.

(8) Clean the support shaft of the F FWD/REW lever, center gear, and play lever, and also the shaft of the F FWD/REW roller and play gear by using a cloth moistened with alcohol, and then apply a small amount of new oil.

(9) Install the play gear, the F FWD/REW roller, the play lever, the center gear, and the F FWD/REW lever by reversing the removal procedure.

(10) Install the reel base drive gear assembly. The prong on the end of the mode select slide should fit into the hole in the mode select lever.

(11) Install the reel motor belt.

(Caution)

Be sure that the belt is not twisted, and be careful that oil does not get on the belt.

(12) Install the ratchet brake. Part A of the ratchet brake should be in contact with the wire of the mode select lever.

(13) Install the supply reel base, the take-up reel base, and the FL mecha. Assy..

(Caution)

The reel base drive gear assembly should be disassembled for cleaning and lubrication only.

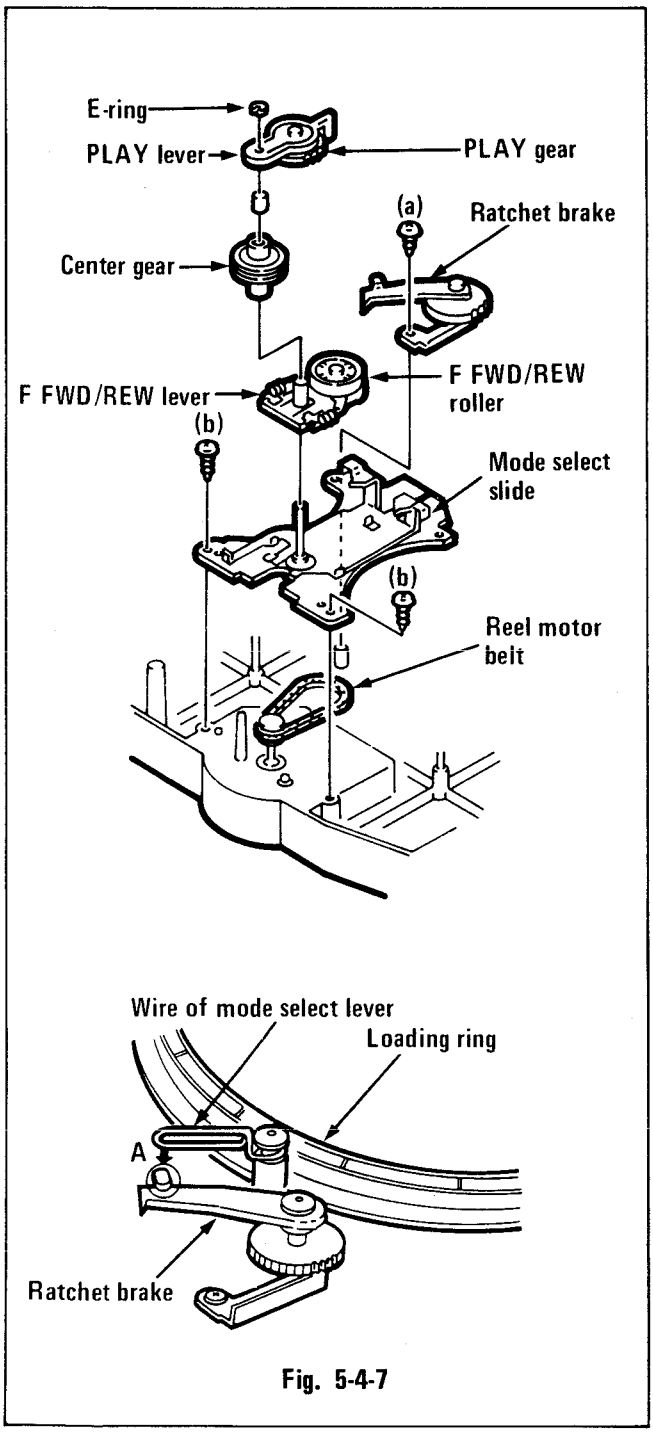


Fig. 5-4-7

8. BACK TENSION BRAKE BAND (See Fig. 5-4-8.)

(1) Remove the FL mecha assy.. (Refer to item "B. PREPARATIONS FOR ADJUSTMENT".)

(2) Remove the supply reel base. (Refer to item "5. SUPPLY REEL BASE".)

(3) Remove the reel base drive gear assembly. (Refer to item "7. REEL BASE DRIVE GEAR ASSEMBLY".)

(4) Disconnect the brake band lever from the back tension lever.

(5) Remove the screw (a) which holds the brake band bracket.

(6) Remove the back tension brake band by passing the brake band lever under the loading ring.

(7) Install the new brake band by reversing the removal procedure.

(Caution)

Be careful not to crease or scratch the new brake band.

(8) Install the reel base drive gear assembly.

(9) Install the supply reel base.

(10) Adjust the position of the back tension lever. (Refer to item "E. ADJUSTMENTS, 1. REEL BASE HEIGHT".)

(11) Install the FL mecha. assy..

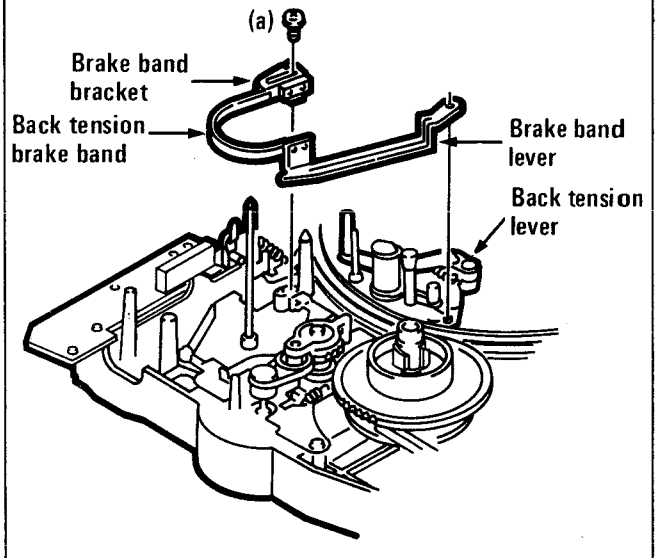


Fig. 5-4-8

9. AUDIO/CONTROL HEAD (See Fig. 7-4-9.)

(1) Remove the screws (a, b) which hold the audio/control head assembly, and then remove the soldered lead wire.

(2) Install the new audio/control head assembly.

(Caution)

Be careful to solder the lead wire at the correct position.

(3) Adjust the tape path. (Refer to item **"F. TAPE PATH ADJUSTMENTS"**.)

(Note)

Play the service alignment tape **(VJ-0113)** or a previously recorded tape; if the playback is normal, adjustment is not necessary.

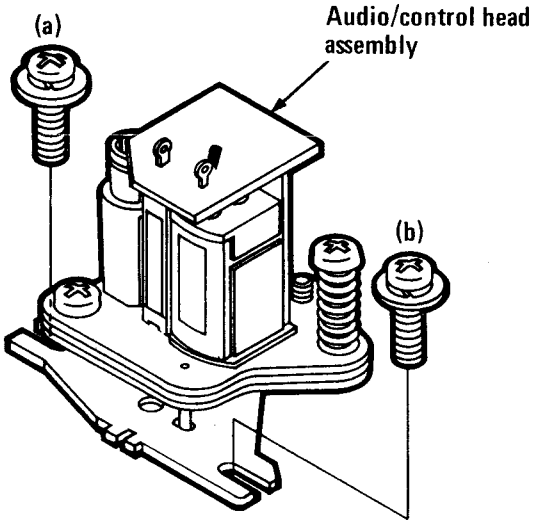


Fig. 5-4-9

10. FWD SENSOR (See Fig. 5-4-10.)

(1) Remove the lead wire soldered to the FWD sensor.

(2) While pressing part A of the FWD sensor in the direction of the arrow, remove the sensor by lifting it upward.

(3) Install the new FWD sensor.

(4) When doing the installation, fit the hole (B) of the FWD sensor onto the prong (C) of the bracket head, and press downward.

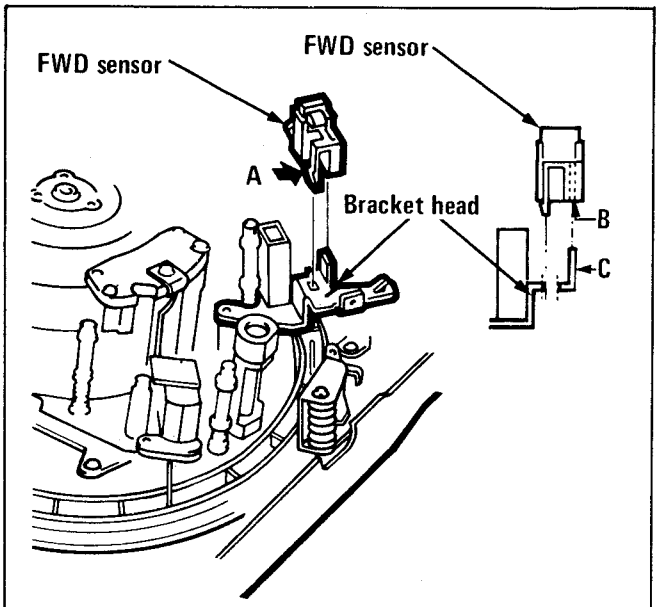


Fig. 5-4-10

11. REW SENSOR (See Fig. 5-4-11.)

(1) Remove the lead wire soldered to the REW sensor.

(2) Remove the screw (a), and then remove the REW sensor assembly.

(3) Remove the screw (b), and remove the capacitor soldered to the REW sensor.

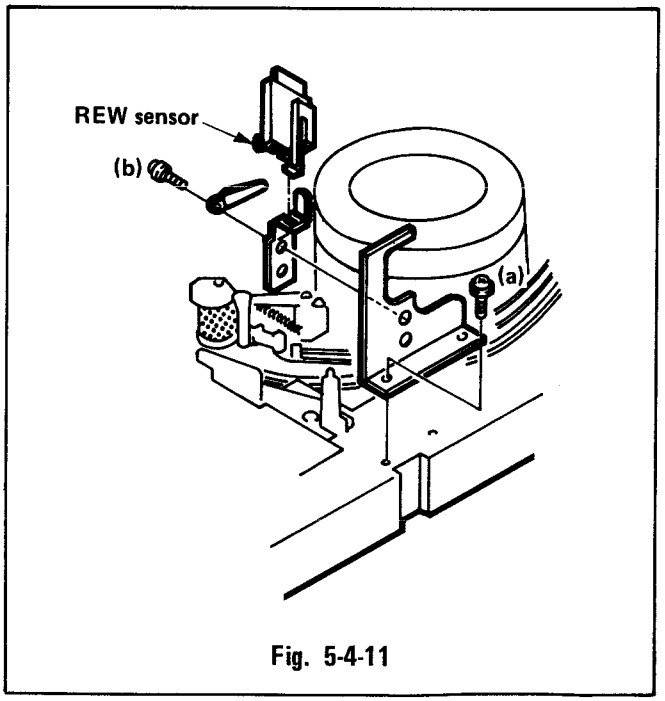


Fig. 5-4-11

12. CAPSTAN MOTOR (See Fig. 5-4-12.)

(1) Disconnect the capstan motor connector.

(Caution)

Be sure that the power is off [the power switch is in the "STAND BY" position] when connecting or disconnecting the connector.

(2) Remove the capstan motor bracket screws (a), and then remove the bracket.

(3) Remove the screws (b) securing the capstan motor, and then remove the motor.

(4) Install the new capstan motor by using the reverse order of the removal procedure.

(5) Adjust the tape path.

(Note)

Play the service alignment tape **(VJ0113)** or a previously recorded tape; if the playback is normal, adjustment is not necessary.

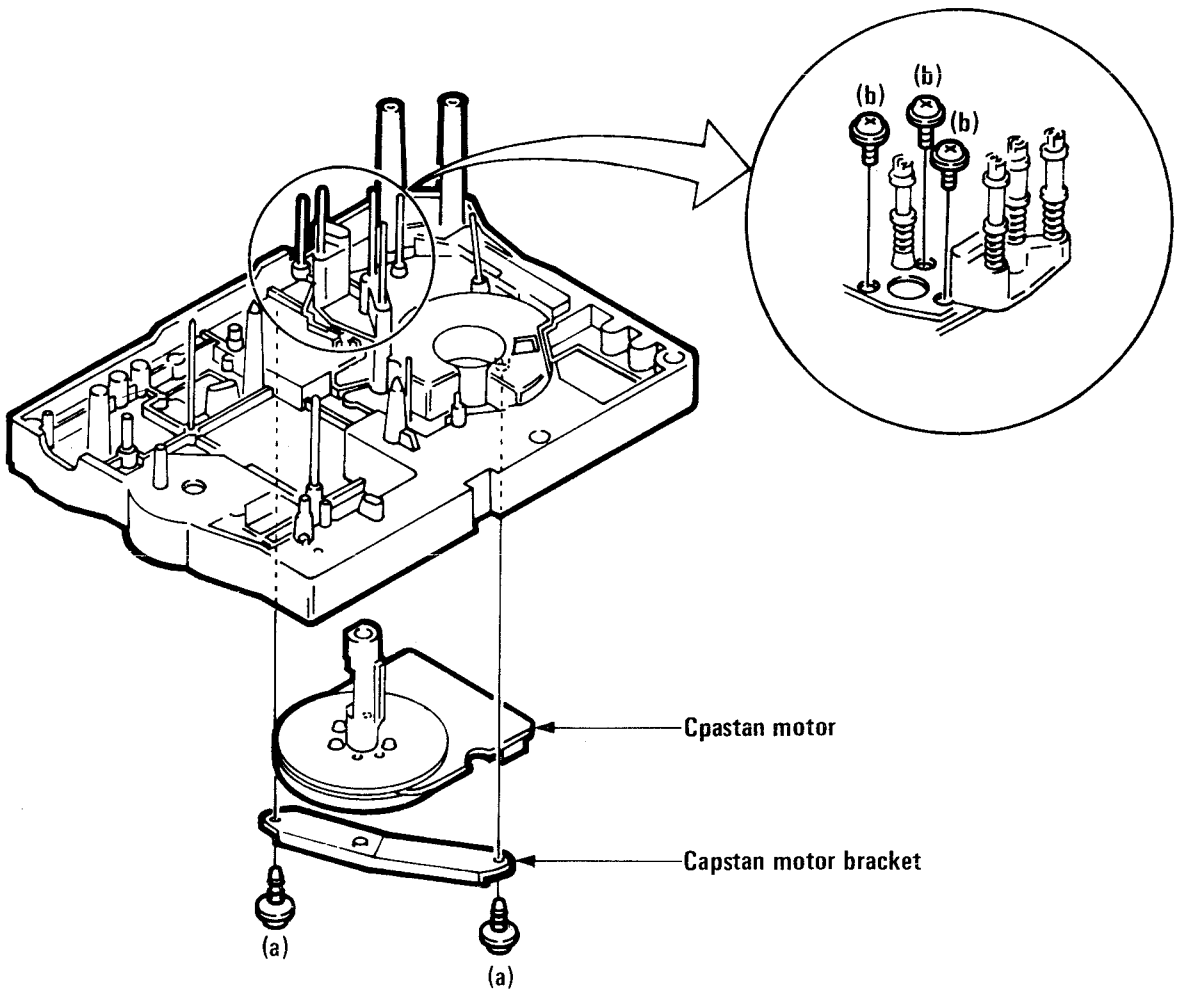


Fig. 5-4-12

13. LOADING MOTOR (See Fig. 5-4-13.)

(1) Remove the lead wire soldered to the loading motor.

(2) Remove the loading motor bracket screws (a), and then remove the loading motor assembly.

(3) Remove the loading belt.

(4) Remove the screws (b) which secure the loading motor, and then remove the motor.

(5) Loosen the set screw (c) which secures the loading motor pulley by using the Allen wrench (VJ-0108 ... M2.6), and then remove the pulley.

(6) Mount the loading motor pulley to the new loading motor.

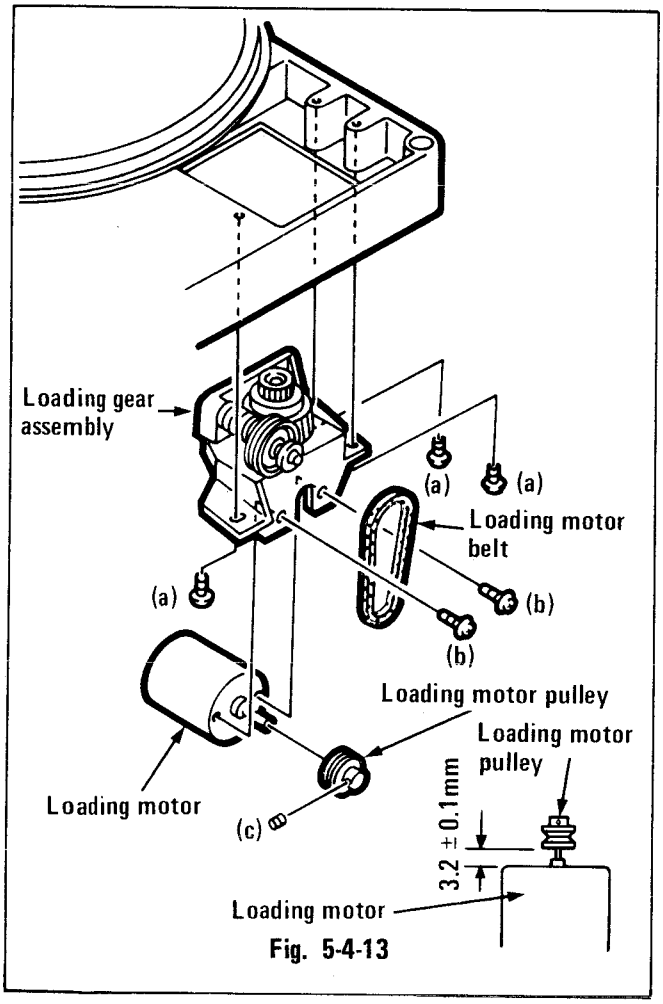


Fig. 5-4-13

(Caution)

When mounting the loading motor pulley be sure to adjust the height.

(7) Install the loading motor by using the reverse order of the removal procedure.

14. LOADING RING (See Fig. 5-4-14.)

(1) Remove the FL mecha. assy.. (Refer to item **"B. PREPARATIONS FOR ADJUSTMENT".**)

(2) Remove the supply reel base. (Refer to item **"5. SUPPLY REEL BASE".**)

(3) Remove the ratchet brake.

(4) Insert the curved tip A of the pressure spring attached to the pinch roller pressure lever into the hole B in the lever.

(5) Cut the fixer securing the lead wire to the bracket head. Remove the solder from the E-head (full-erase head) terminal, and then remove the lead wire. Remove the screw securing the bracket head, and then remove the bracket head.

(6) Remove the REW sensor assembly. (Refer to item **"11. REW SENSOR".**)

(Caution)

It is not necessary to remove the lead wire which is soldered to the REW sensor.

(7) Disconnect the connectors, lead wires, etc.

* The video head lead wire connector (the 6-pin connector which is connected to circuit board VD-1)

* The various lead wire connectors for the audio/control head, the full-erase head, etc.

* The DEW sensor (Do no break the solder on the DEW sensor.)

(8) Remove the bracket screws (a) of the loading ring support rollers, and then remove the bracket.

(9) While pressing the back tension lever in the direction of arrow C and the mode select slide in the direction of arrow D, slide the loading ring upward and remove it.

(Caution)

When pressing the back tension lever, be careful not to press the back tension guide. In addition, be careful not to scratch the video head drum, the video heads, the audio/control head, the back tension guide, etc., and do not touch the loading guide or the pinch roller.

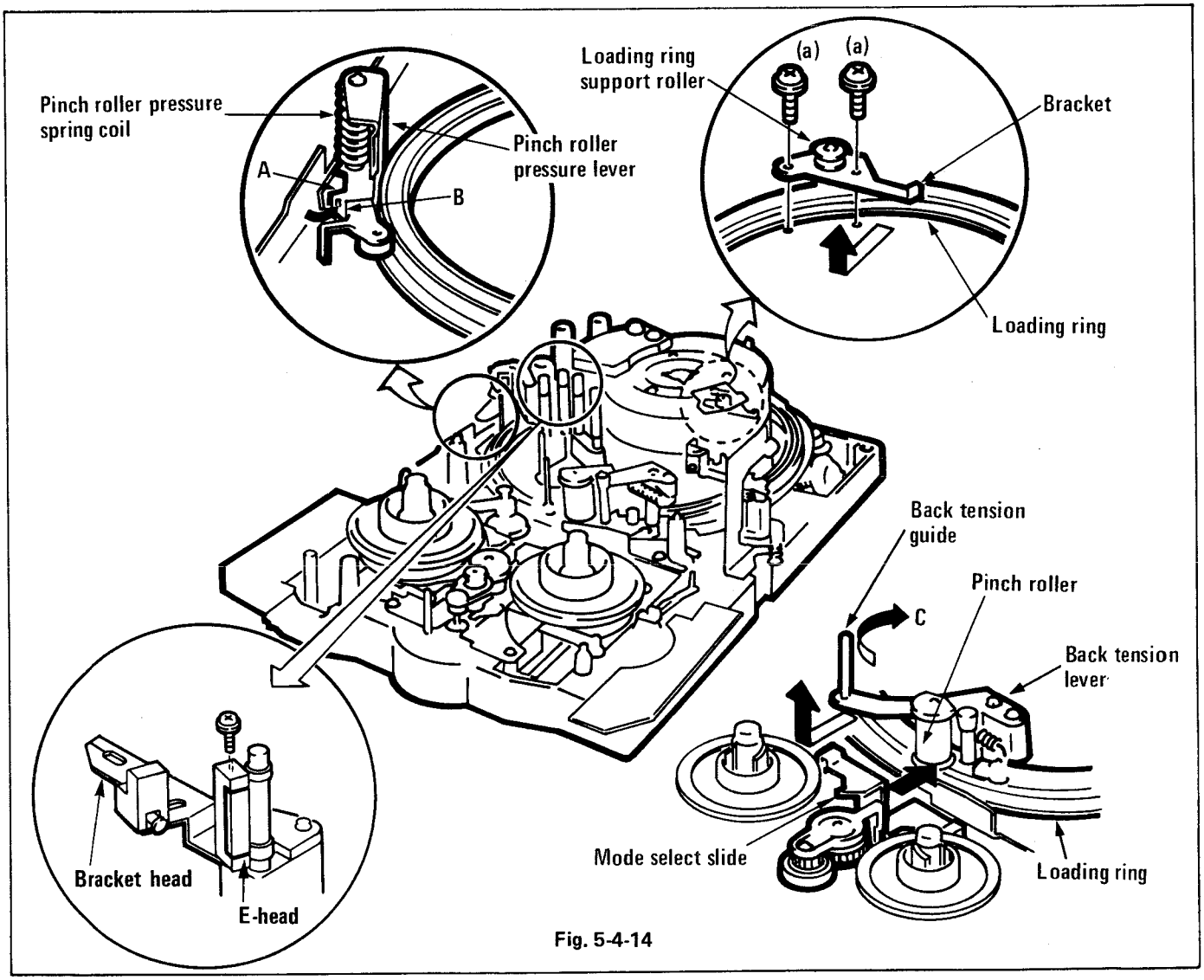


Fig. 5-4-14

[Loading ring installation] (See Figs. 5-4-15, 5-4-16)

(1) While pressing the back tension lever in the direction of arrow C and the mode select slide in the direction of arrow D, insert the loading ring, and fit it into the grooves of the two support rollers on the secured side.

(Caution)

When pressing the back tension lever, be careful not to press the back tension guide.

(2) Tighten the bracket screws (a) of the loading ring support rollers.

(Caution)

Be sure that the loading ring is set inside the grooves of the support rollers at all three places. Also, be sure that the loading gear and the loading ring gear are securely intermeshed.

(3) Set the loading ring to the condition at the completion of loading.

* Install the bracket head.

* Pass the fixer through the hole in the bracket head, and then bunch and secure the lead wire. Be sure that the lead wire does not hang down, and be careful not to put too much pressure on the bracket head.

* Solder the lead wire to the full-erase head terminal.

(4) Remove the curved tip A of the pinch roller pressure spring from the hole B in the pinch roller pressure lever, and connect it to the wall of the main chassis.

(5) Install the ratchet brake and other parts by reversing the order of the removal procedure.

(Caution)

When the loading ring is in the condition of loading completion, install the REW sensor assembly as shown in Fig. 5-4-16.

(6) Play a previously recorded tape, and check that there is nothing wrong with the tape path.

(Caution)

When installing the loading ring, be careful not to scratch the video head drum, the video heads, the audio/control head, the back tension guide, etc.

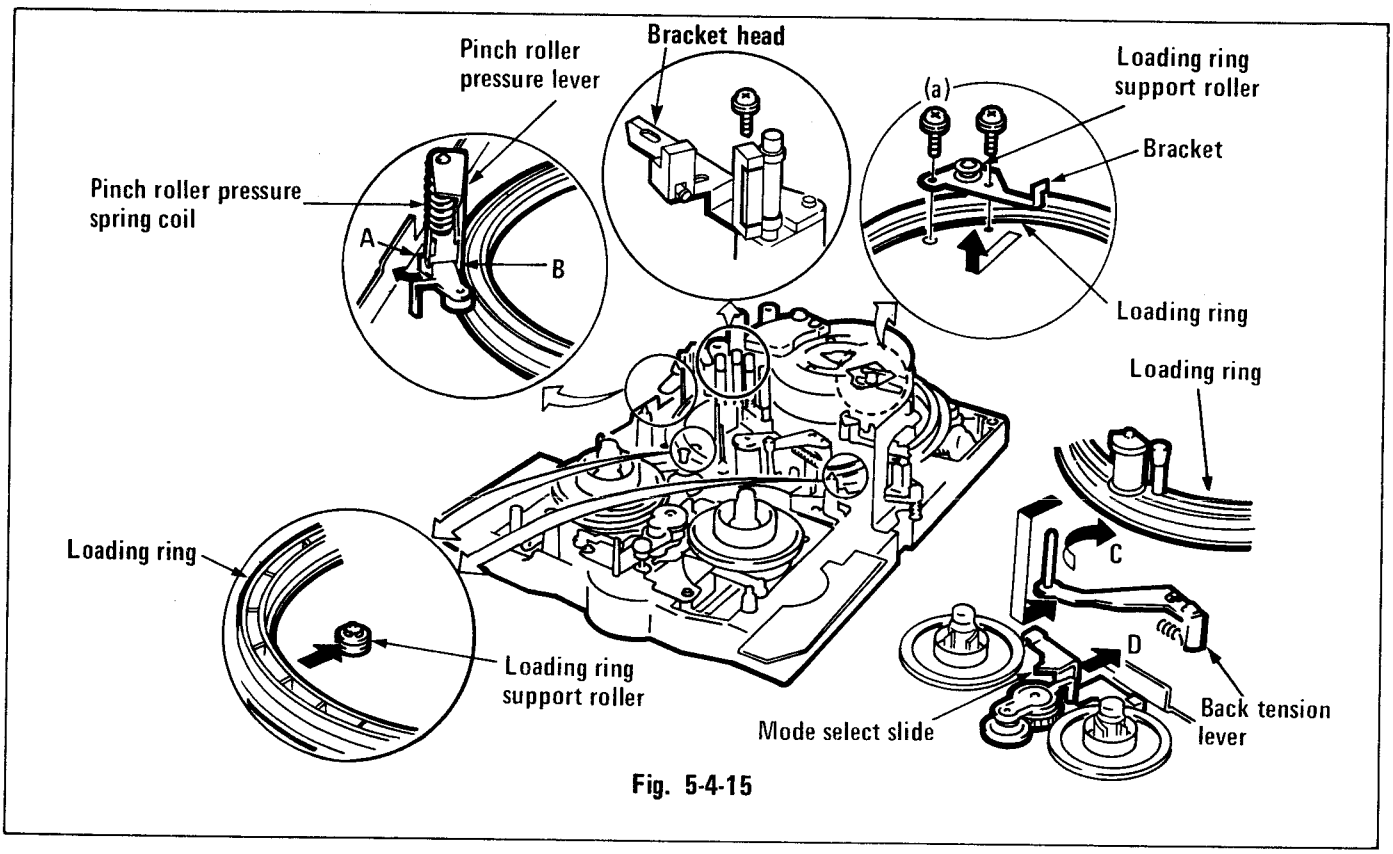


Fig. 5-4-15

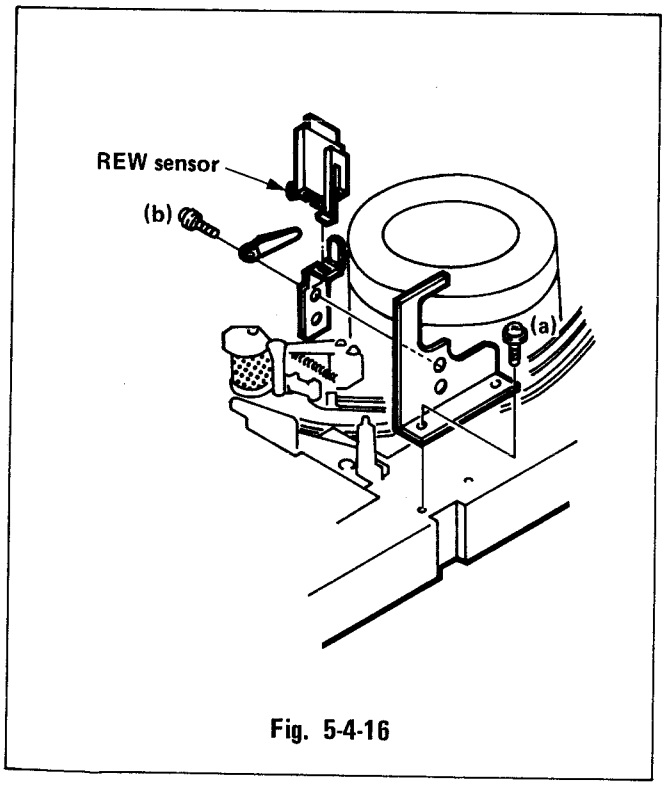


Fig. 5-4-16

15. REEL MOTOR (See Fig. 5-4-17.)

(1) Remove the FL mecha. assy.. (Refer to item "B. PREPARATIONS FOR ADJUSTMENT".)

(2) Remove the lead wire which is soldered to the reel motor.

(3) Remove the reel motor belt.

(4) Remove the reel motor mounting screws (a), and then remove the motor.

(5) Loosen the set screw (b) which secures the reel motor pulley by using the Allen wrench (VJ-0108....M2.6), and then remove the pulley.

(6) Mount the reel motor pulley onto the new motor.

(Caution)

When mounting the pulley, be sure to adjust the height.

(7) Install the reel motor by using the reverse order of the removal procedure.

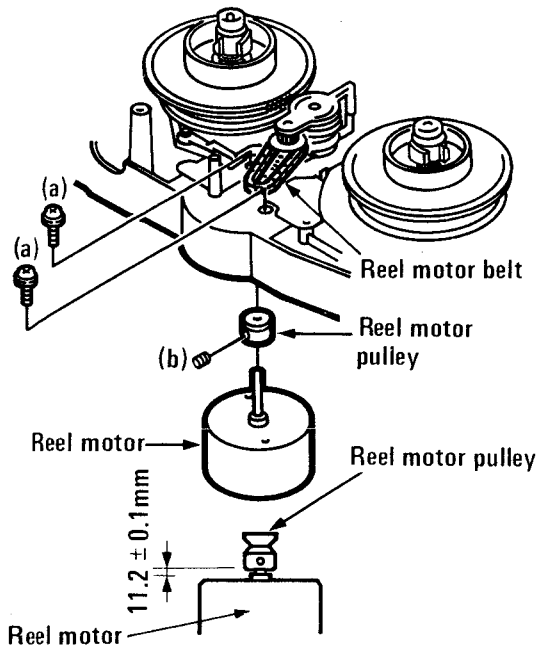


Fig. 5-4-17

16. VIDEO HEAD DISC (See Fig. 5-4-18.)

(1) Remove the solder of the PG lead wire (the lead wire connected to circuit board MC-4 which is part of video head drum A).

(2) Remove the DEW sensor.

(Caution)

Do not break the solder on the DEW sensor. Also note that the performance of the DEW sensor will be impaired if it is subjected to high temperatures for an extended period of time.

(3) Remove the screws (a), and the, while raising up video head drum A, loosen the M3 screws (b) by using a Phillips (cross-tip) screwdriver and remove video head drum A.

(4) Remove the screws (c) which secure the rotary transformer.

(5) Break the solder of rotary transformer lead wires (1), (2), (3), and (4), and then remove the transformer.

(Caution)

Make note of the soldered locations for each of the rotary transformer lead wires.

(6) Remove the screws (d) which secure the video head disc, and then replace the disc.

(Caution)

When installing the new video head disc, pay attention to the following points:

* Tighten each of the screws (d) with an equal amount of torque (6 kg-cm). Do not overtighten them.

* Do not remove the spacer underneath the video head disc. Install the new video head disc right onto the old spacer. (It is possible that there is no spacer.)

* Solder the lead wires in their original positions, and shape them so that they follow along the video head disc and do not come in contact with drum A.

(7) Install the remaining parts by reversing the order of the removal procedure.

(Caution)

The M3 screws (b) determine the position of drum A. Tighten them with a torque of 1 kg or less.

(8) Play the service alignment tape (VJ-0061) or a previously recorded tape. If the image is not correct, and a correct image cannot be obtained by adjusting the tracking control, adjust the tape path. (Refer to item "**F. TAPE PATH ADJUSTMENTS**".)

(9) If a slipping noise is head from the video head drum when the tape is played back, it is probably because the video head drum is not installed properly; loosen the screws (a) and the M3 screws (b) again and adjust drum A.

(Caution)

If the slipping noise is still heard after the adjustment is made, it indicates that the cause is a different thickness of the video head disc; turn the gap adjusting screws (e) 30° ~ 40° counter clockwise from the point at which are slipping noise is heard. (Tighten the gap adjusting screws (e) uniformly.)

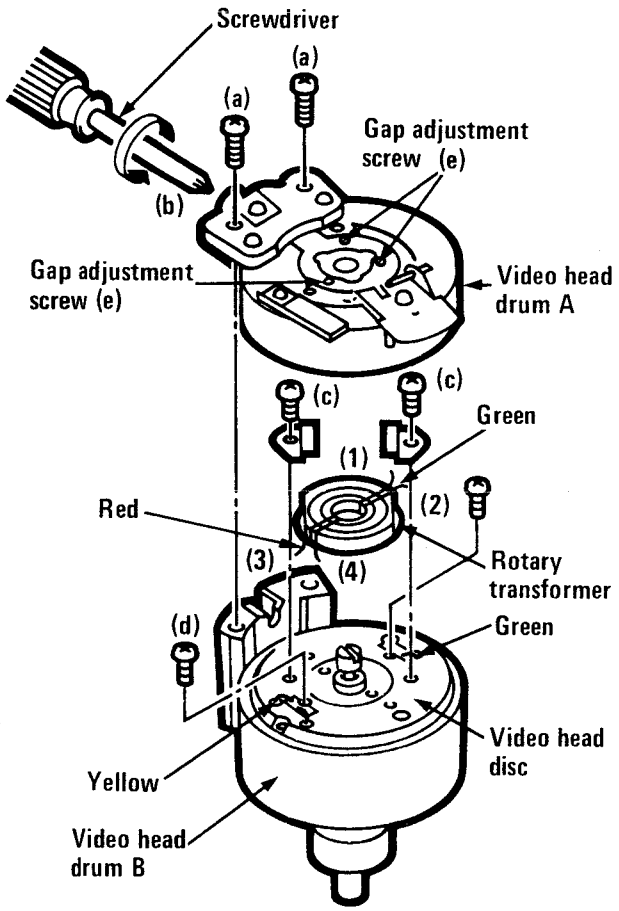


Fig. 5-4-18

17. SLIP ROLLER ASEMBLY AND BELT (Fig. 5-4-19)

(1) Remove the front loading mechanism assembly. (Refer to B. **PREPARATIONS FOR MECHANISM ADJUSTMENT**)

(2) Rotate the slip roller assembly clockwise, and slightly move the cassette holder from the completed cassette eject position.

(3) Remove the screw (a) holding the worm cap, and then remove the worm cap, the belt, the 2.5mmϕ washers (2), the slip roller assembly, and the 3.0mmϕ washers (2).

(Caution)

If the worm cap is removed in the completed cassette eject position, the slip roller assembly will fly off.

(4) Clean the shaft of the slip roller assembly with a cloth moistened with alcohol and then apply new (SUN X-5) grease.

(5) Replace the 3.0mmϕ washers, the slip roller assembly, the 2.5mmϕ washers, the belt, and the worm cap in the revers order of disassembly.

(Caution)

1. Do not mistake the order of the washers.
2. Use only the specified grease on the washers. Molycaost grease, in particular, will cause problems if it comes in contact with the worm spindle gear, so do not use it.
3. Be careful not to twist or get oil or grease on the belt.

(6) Rotate the slip roller assembly counterclockwise, and move the cassette holder to the completed cassette eject position.

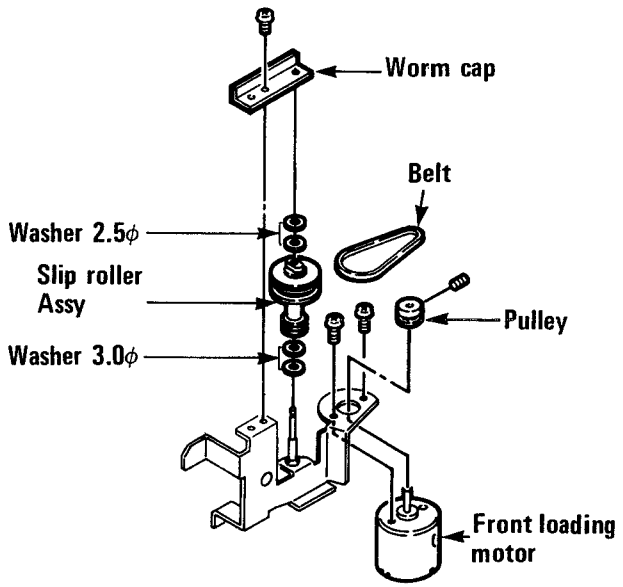


Fig. 5-4-19

18. FRONT LOADING MOTOR (Fig. 5-4-20)

(1) Remove the front loading mechanism assembly. (Refer to B. **PREPARATIONS FOR MECHANISM ADJUSTMENT.**)

(2) Remove the belt, and then by using an allen wrench (VJ-0108 . . . M2.6) remove the Allen screw holding the front loading motor pulley.

(3) Remove the 2 screws (b) holding the front loading motor, and remove the front loading motor.

(4) Reattach the new front loading motor in the reverse order of removal.

(Caution)

When attaching the front loading motor pulley, adjust it to the height shown in Fig. 5-4-20.

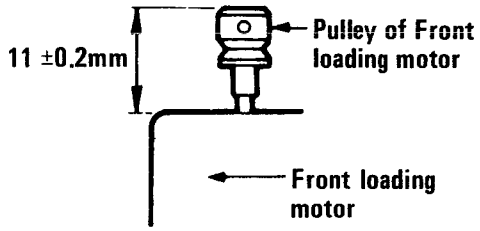


Fig. 5-4-20

E. ADJUSTMENTS

1. REEL BASE HEIGHT (See Fig. 5-5-1.)

If the reel base height is not correct, the tape inside the cassette will be unevenly wound. When this tape is used again, the unevenly wound tape will cause the tape tension to fluctuate, and the correct tape travel will be impossible to obtain.

(1) Turn off the power. [Set the power switch to the "STAND BY" position.]

(2) Remove the cassette holder. (Refer to item **"B. PREPARATIONS FOR ADJUSTMENT".**)

(3) Insert the standard cassette plate (VJ-0105) and slide the gauge in the direction of the arrows.

(4) Confirm that, when the gauge stops, the reel bases are not in contact with surface A of the plate and are in contact with surface B.

(5) If a reel base is in contact with surface A, remove a spacer and check again.

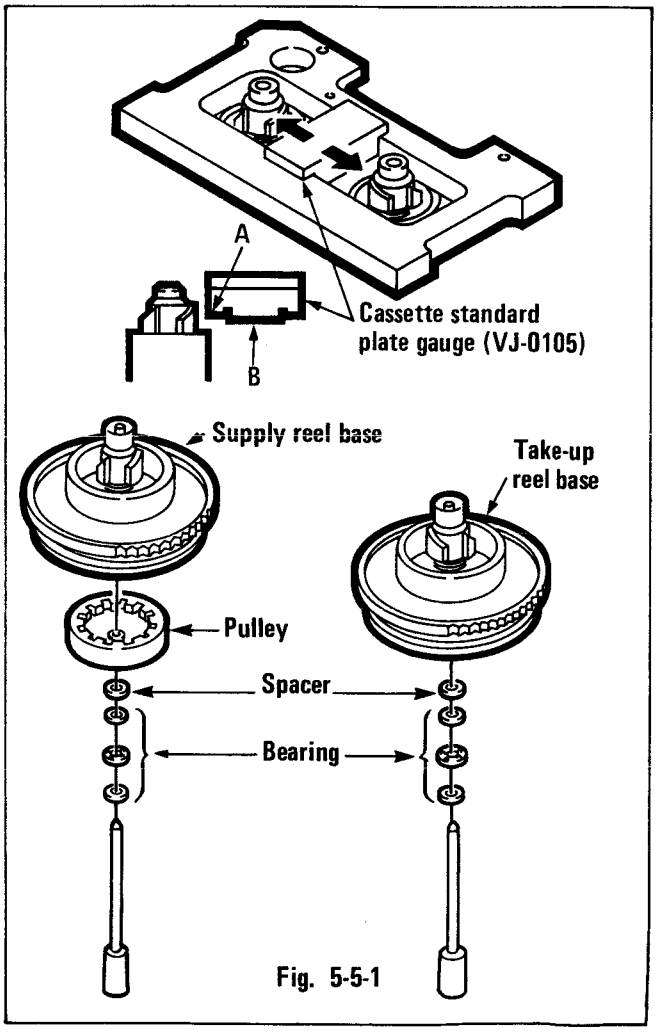


Fig. 5-5-1

(6) If a reel base is not in contact with surface B, add a spacer and check again.

(Note)

Adjust the reel base height by adding or removing spacers (0.13T, 0.25T, 0.5T) as appropriate so that the height meets the specifications. Use the same method for both the take-up reel base and the supply reel base.

2. BACK TENSION LEVER POSITION (See Fig. 5-5-2.)

The back tension must be applied uniformly to the tape so that the tape can travel smoothly with relation to the various heads and tape guides. If the back tension is too strong, it will cause the tape to stretch, and if it is too weak, the tape will separate from the heads and tape guides.

(1) Turn off the power. [Set the power switch to the **"STAND BY" position.**]

(2) Remove the FL mecha. assy.. (Refer to item **"B. PREPARATIONS FOR ADJUSTMENT".**)

(3) Manually operate the loading ring to reach the condition of loading completion.

(4) Insert the back tension adjustment gauge (VJ-0120) and check the position of the back tension guide.

(5) If the position of the back tension guide is not correct, loosen the screw (a), move the brake band bracket, and adjust the position of the back tension guide.

(6) Tighten the screw (a) to secure the position of the brake band bracket.

(7) Move the loading ring to the condition of unloading completion, and install the FL mecha. assy..

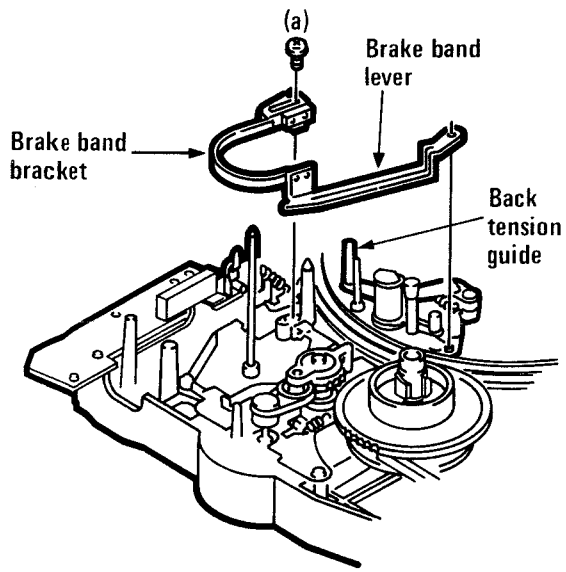


Fig. 5-5-2

3. WINDING TORQUE (See Figs. 5-5-3 ~ 5-5-6.)

In the various modes of the VCR, the tape which leaves the supply (or take-up) reel is wound around the take-up (or supply) reel. If the winding torque is too weak, the tape will not be wound properly and will become slack. On the other hand, if the winding torque is too strong, an excessive amount of tension will be applied to the tape and cause the tape to stretch.

[FWD winding (recording, playback, forward search) torque] (See Fig. 5-5-3.)

(1) Turn off the power. [Set the power switch to the **"STAND BY" position.**]

(2) Remove the FL mecha. assy.. (Refer to item **"B. PREPARATIONS FOR ADJUSTMENT".**)

(3) Turn on the power. [Set the power switch to the "ON" position.]

(4) Mount the reel tension gauge (VJ-0038) on the take-up reel base, and then connect the string to the end of the spring tension gauge (VJ-0012).

(5) Press the PLAY button and measure the torque. The **winding torque should be between 30 g and 53 g.**

(6) If the measured value is not within the specified value range, replace the take-up reel base.

(7) Install the FL mecha. assy..

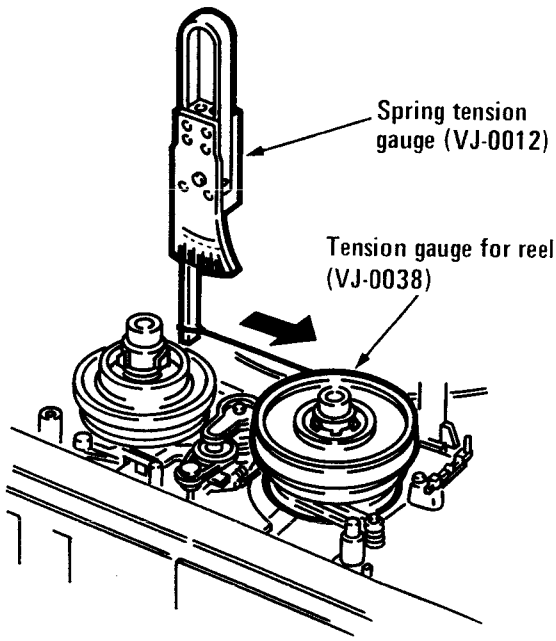


Fig. 5-5-3

[F FWD winding torque] **(See Fig. 5-5-4.)**

(1) Turn off the power. [Set the power switch to the **"STAND BY" position.]**

(2) Remove the FL mecha. assy.. (Refer to item **"B. PREPARATIONS FOR ADJUSTMENT".)**

(3) Turn on the power. [Set the power switch to the "ON" position.]

(4) Mount the reel tension gauge (VJ-0038) on the take-up reel, and then connect the string to the end of the spring tension gauge (VJ-0014).

(5) Press the F FWD button, and measure the torque. The winding torque should be 165 g or more.

(6) If the measured value in less than the specified value, check for a problem with the reel motor belt, and replace the belt if necessary.

(7) Install the FL mecha. assy..

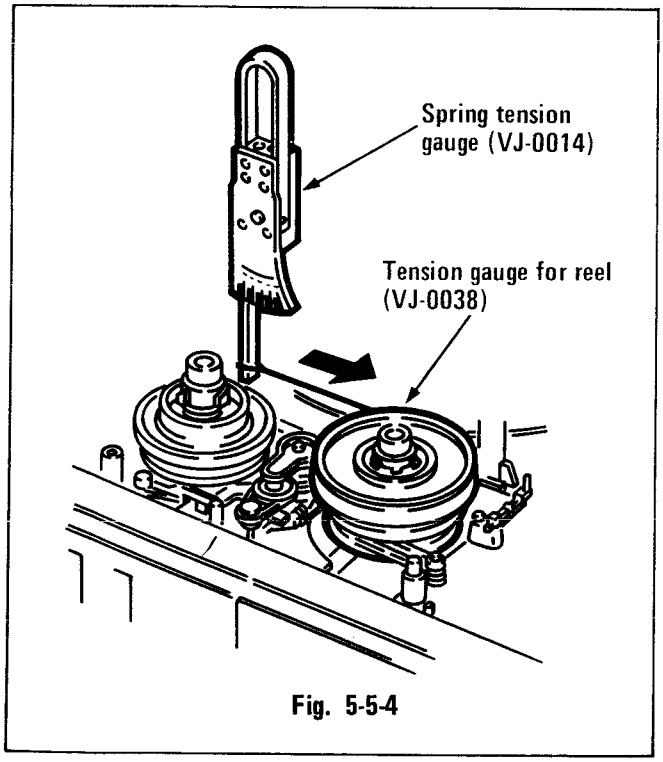


Fig. 5-5-4

[REW winding torque] **(See Fig. 5-5-5.)**

(1) Turn off the power. [Set the power switch to the **"STAND BY" position.]**

(2) Remove the FL mecha. assy.. (Refer to item **"B. PREPARATIONS FOR ADJUSTMENT".)**

(3) Turn on the power. [Set the power switch to the "ON" position.]

(4) Mount the reel tension gauge (VJ-0038) on the supply reel, and then connect the string to the tip of the spring tension gauge (VJ-0014).

(5) Press the REW button, and measure the torque. The winding torque should be 165 g or more.

(6) If the measured value is less than the specified value, check for a problem with the reel motor belt, and replace the belt if necessary.

(7) Install the FL mecha. assy..

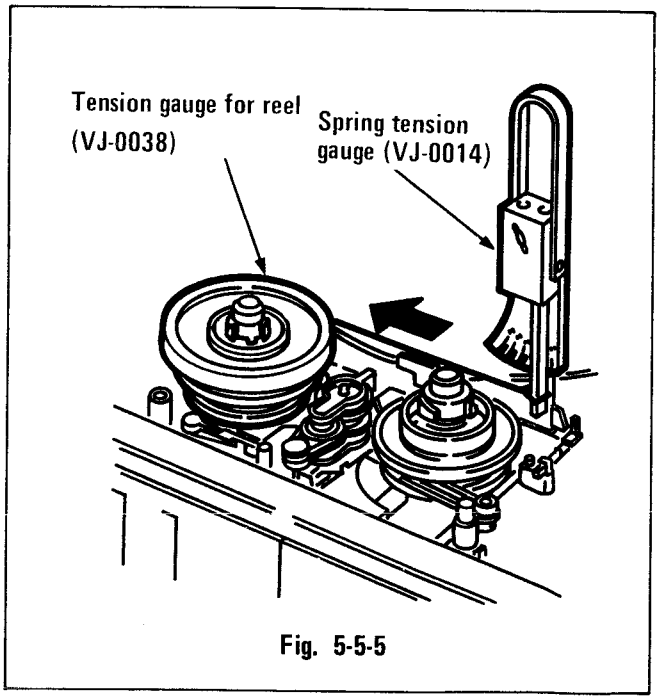


Fig. 5-5-5

[R-SEARCH winding torque] **(See Fig. 5-5-6.)**

(1) Turn off the power. [Set the power switch to the **"STAND BY" position.]**

(2) Remove the FL mecha. assy.. (Refer to item "B. PREPARATIONS FOR ADJUSTMENT".)

(3) Turn on the power. [Set the power switch to the "ON" position.]

(4) Mount the reel tension gauge (VJ-0038) on the supply reel, and then connect the string to the end of the spring tension gauge (VJ-0012).

(5) Press the R-SEARCH button, and measure the torque. The winding torque should be between 58 g and 74 g.

(6) If the measured value is not within the specified value range, replace the supply reel base.

(7) Install the FL mecha. assy..

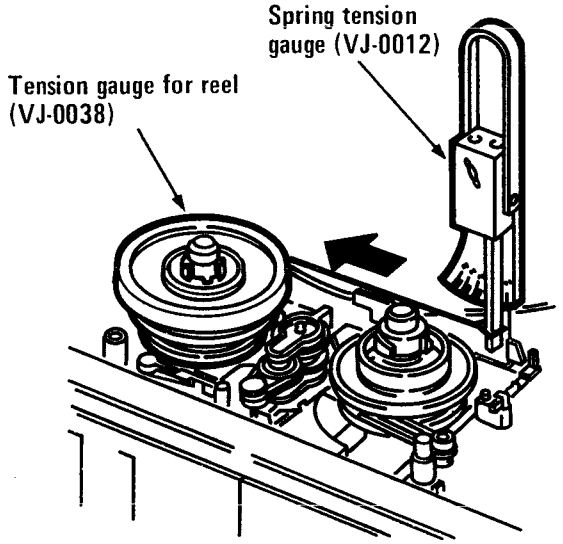


Fig. 5-5-6

F. TAPE PATH ADJUSTMENTS

Each of the heads and tape guides has been adjusted to the precisely correct position and height. These parts have a very strong influence on tape travel, and should normally not be touched. If the video head drum, the full-erase head, the audio/control head, etc., have been replaced, playback the service alignment tape **(VJ0113)** or a previously recorded tape, and check the image. Only if there are problems with the image that cannot be corrected by adjusting the tracking control should tape path adjustments be made. Also note Also note that tape path adjustments should be made without removing the FL mecha. assy. (only remove the top board B).

1. BACK TENSION GUIDE VERTICAL POSITION (See Fig. 5-6-1.)

(1) Play a tape on which the edges are not stretched, and check that there is no looseness in both the upper and lower edges of the tape in the area of the back tension guide.

(2) If there is any looseness, adjust the screws (a), (b) so that the tension is applied evenly to the tape.

(Note)

Adjustment for the tape entering the back tension guide (direction A → A') is made by using screw (a), and that for the tape leaving the back tension guide (direction B → B') by using screw (b).

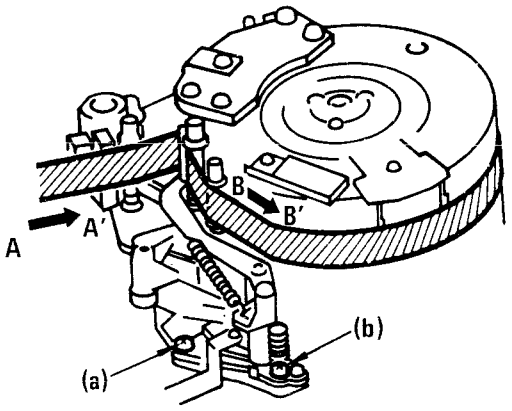


Fig. 5-6-1

2. FULL-ERASE HEAD TAPE GUIDES (See Figs. 7-6-2 ~ 7-6-4.)

(1) Connect an oscilloscope to the video output terminal (the check terminal of circuit board VD-1, pin (3) of S1006). and then playback the service alignment tape **(VJ0113).**

(2) Check the tape travel in the area of the back tension guide. If there is any looseness in either the upper or lower edges of the tape, adjust tape guides (a), (b), and (c) so that the guide flanges are not in contact. **(See Fig. 5-6-2.)**

(3) While checking the waveform (envelope), adjust tape guide (a) so that the lower flange of the guide supports the lower edge of the tape. Next, adjust so that the size of amplitude A of the waveform is approximately −6dB (1/2 the size) in relation to the size of amplitude B of the waveform at a position approximately 2/5 from the head switching point. **(See Fig. 5-6-3.)**

(4) While checking with the inspection mirror (VJ-0015), adjust tape guides (b) and (c) so that the upper flanges of the guides do not cause any creases in the tape, lowering both guide (b) and guide (c) equally in order to maximize the size of amplitude A. **(See Fig. 5-6-4.)**

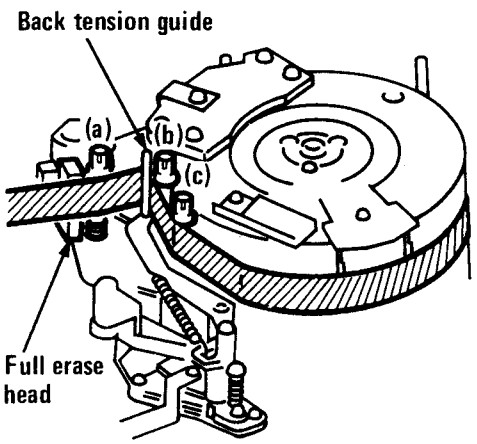


Fig. 5-6-2

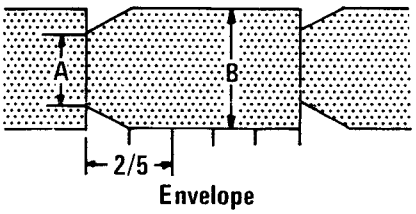


Fig. 5-6-3

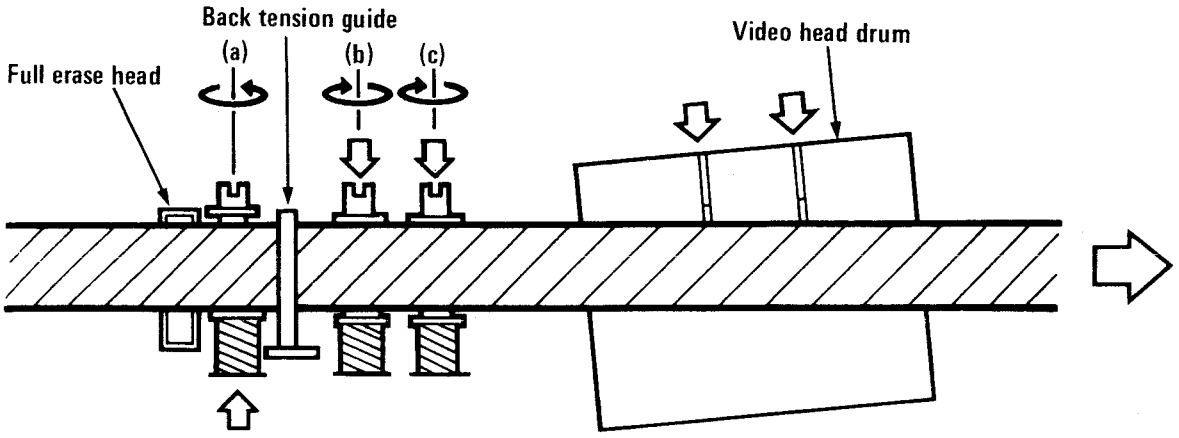


Fig. 5-6-4

3. AUDIO/CONTROL HEAD TAPE GUIDES (See Figs. 5-6-5, 5-6-6.)

(1) Connect an oscilloscope to the video output terminal (the check terminal of circuit board VD-1, pin (3) of S1006), and play back the service alignment tape **(VJ-0113).**

(2) Check the tape travel in the area of the audio/control head. If there is any looseness in either the upper or lower edges of the tape, adjust tape guides (a) and (b) so that the guide flanges are not in contact. **(See Fig. 5-6-5.)**

(3) While checking the waveform (envelope), adjust tape guide (b) so that the upper flange of the guide supports the upper edge of the tape. Next, adjust so that the size of amplitude A of the waveform is approximately −3dB ~ −6dB (2/3 ~ 1/2 the size) in relation to the size of amplitude B of the waveform at a position approximately 2/5 from the head switching point. **(See Fig. 5-6-6.)**

(4) While checking with the inspection mirror (VJ-0015), adjust tape guide (a) so that the upper flange of the guide does not cause, any creases in the tape, lowering guide (a) so that the size of amplitude A is maximized. **(See Fig. 5-6-7.)**

(5) If either the upper or lower edge of the tape is not in contact with the audio/control lead and the tape guides and there is a unbalance between the top and the bottom, it is probably caused by the audio/control head slanting either forward or backward. (Refer to item "4. AUDIO/CONTROL HEAD).

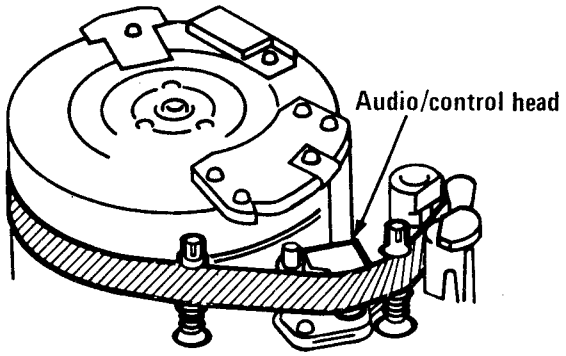


Fig. 5-6-5

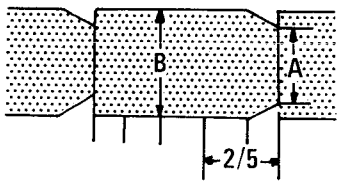


Fig. 5-6-6

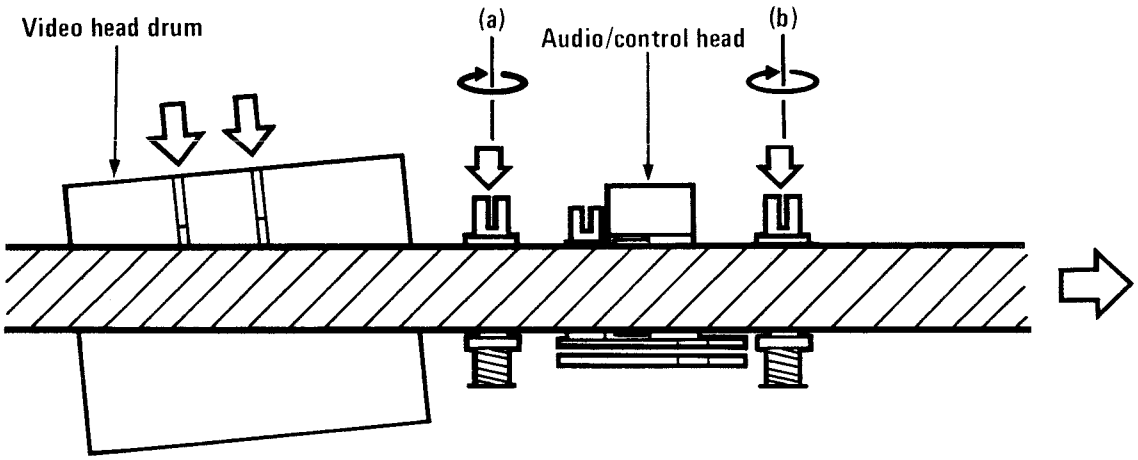


Fig. 5-6-7

4. AUDIO/CONTROL HEAD (See Fig. 5-6-8.)

Connect an oscilloscope to the audio output terminal (back side terminal part of set), and then playback the service alignment tape **(VJ-0113).**

[Slanting forward or backward]

Check the tape travel. If either the upper or lower edge of the tape is not in contact with the audio/control head and the tape guides, and there is an unbalance between the top and the bottom, adjust the Allen screw (a) by using the Allen wrench (VJ-0022). When the Allen screw (a) is turned to the right (clockwise), the audio/control head will slant forward, and when the Allen screw (a) is turned to the left (counter clockwise), the audio/control head will slant backward.

[Head height]

Adjust nut (b) with a flat-tipped screwdriver so that the audio output is maximized.

[Azimuth (head left-right angle)]

Adjust screw (c) with a Phillips (cross-tipped) screwdriver so that the audio output is maximized.

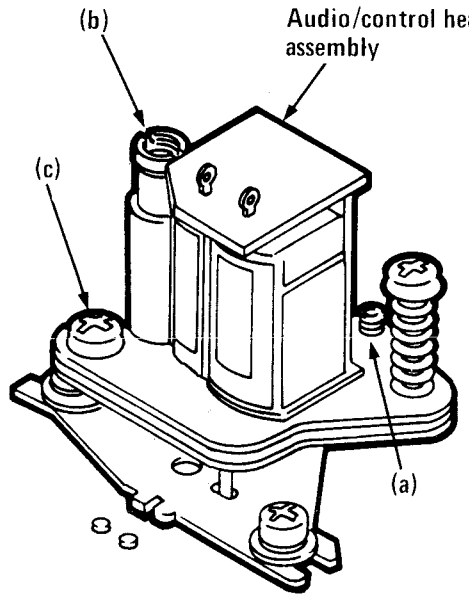


Fig. 5-6-8

5. TRACKING (See Fig. 5-6-9.)

(1) Connect an oscilloscope to the video output terminal (the check terminal of circuit board VD-1, pin (3) of S1006), and playback the service alignment tape **(VJ-0113).**

(2) Loosen screws (a) and (b) approximately a 45° (1/4) turn only, insert a flat-tipped screwdriver into the notch (c), and turn left and right to adjust so that the waveform (envelope) observed on the oscilloscope is maximized.

(Caution)

If screws (a) and (b) are loosened too much and the adjustment is made, the proper adjustment might be lost when the screws are retightened.

(3) After making the adjustment, retighten screws (a) and (b).

(4) Next, playback a tape which was previously recorded in the βIII mode, and confirm that the envelope is maximized when the tracking control is at the center position.

(Caution)

If the envelope appears to be minimized when the tracking control is at the center position, readjust the tracking control and set it to a different envelope maximum point.

(5) Turn the tracking control to the right and left so that the waveform (envelope) which appears on the oscilloscope changes fairly evenly.

(6) Record and playback a television broadcast, and confirm that there are no problems with the image on the screen.

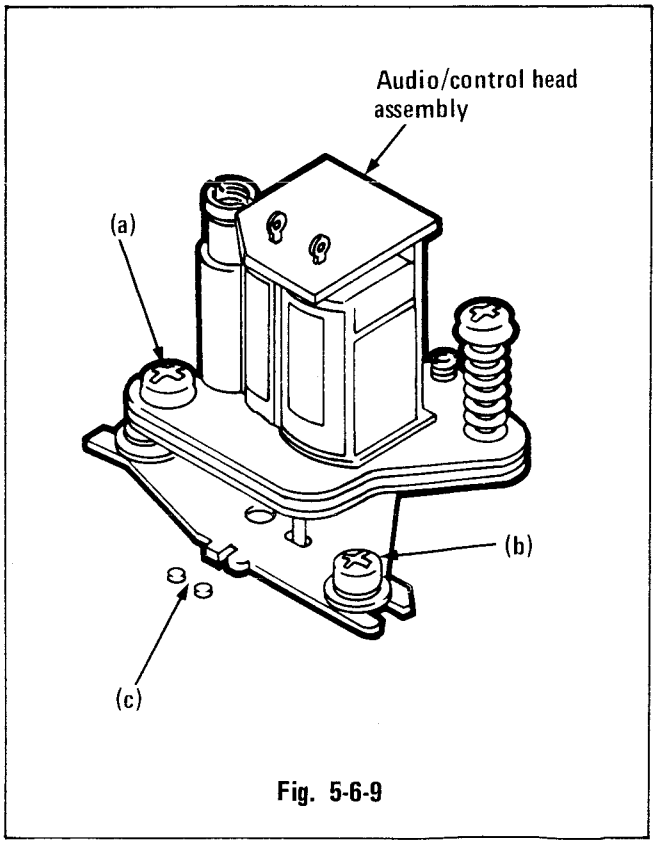


Fig. 5-6-9

VI. CIRCUIT DESCRIPTION

A. VIDEO CIRCUIT

(1) OPERATION OF THE PRE-AMPLIFIER (VP-1) (Fig. 6-1-1, Fig. 6-1-2)

1. PLAYBACK SYSTEM

First, the signals (the FM-modulated Y signals and the low-range-converted C signals) recorded on the tape are picked up by the four heads (CA, NA, CB and NB) shown in Fig. 1. Those signals pass through the 4-channel rotary transformer and enter the VP-1 printed-circuit board. See Fig. 2 below. Depending upon the position of the system-control switch, relay RY1501 is switched, by the NTSC H signal controlled by the system-control switch, to ON during NTSC operation and to OFF at other times, so that the respective mode is selected, and the signals which entered the VP-1 printed-circuit board are led to step-up transformers T1501 and T1502.

Then, during the CCIR mode, these signals are input to FET amplifiers Q1502 and Q1503; during the NTSC mode, the frequency response and level during playback are controlled by CT1502, VR1506 and VR1507, and the signals are input to FET amplifiers Q1502 and Q1503. Next, the output of the FET amplifiers is input by IC1501 LA7027.

Channel A, pin (24); channel B, pin (23). After amplification, the level of the resonance point of channel A and channel B is adjusted by VR1502 and VR1503 connected to pin (20) and pin (21). At this time, during the NTSC mode, the Q1514 transistor becomes ON, and during NTSC only channel A and channel B gain changes slightly. The reason for this is, for reasons related to the fact that the innermost of the rotary transformers is used as the NTSC channel B and the second from the innermost is used as the NTSC channel A, the transfer function of the rotary transformers is greatly different, so that the difference of the signal level of channel A and channel B is in this way corrected. Next, the channel A and channel B signals are input to the switching circuit, are selected by the RF switching pulse of pin (18), and are output from pin (16) and pin (17). After that, they are converted to continuous waves by the resistance mixing circuit (R1526 – R1531), and one is input to VD-1 as the playback chroma signal.

One other is input to pin (14), and the remaining one is input to pin (15) after passing through the HPF composed of C1518.

The signals input to pin (14) and pin (15) are selected, respectively, by the pin (12) ACK and STD/SPH signals. Then, the main Y FM signals pass through the limiter amplifier, and are input to the DOC switch. The D.O.C. detection from before the limiter amplifier controls the D.O.C. switching.

The D.O.C. detection level is adjusted by VR1501, which is connected to pin (3). The DOC switch switches the main Y FM signals (which have passed through the limiter) and the 1H delay signals (which were output from pin (4), have passed through the 1H delay line of VD-1, and have returned to pin (6)) at the D.O.C. switching circuit. Then, the drop-out compensated Y FM signals are output from pin (4) and are input to VD-1.

2. RECORDING SYSTEM

The FM-converted Y signals are input to the Y-recording amplifier (composed of Q1507 – Q1510), the recording Y level is adjusted by VR1504, and the recording frequency characteristics are adjusted by VR1505, after which the signals pass through the step-up transformer and are recorded. The chroma signals, subjected to low-range conversion (688kHz), are input to the C-recording amplifier, Q1511, are mixed with the FM-converted Y signals, and are recorded.

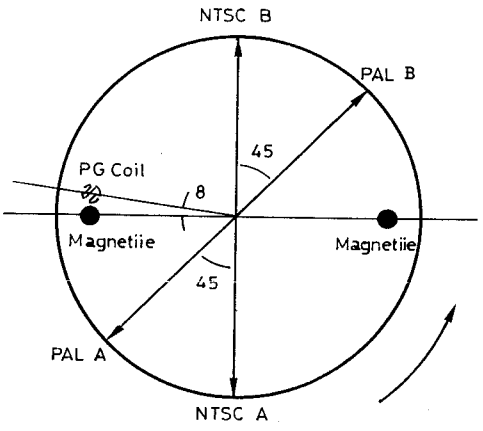


Fig. 6-1-1

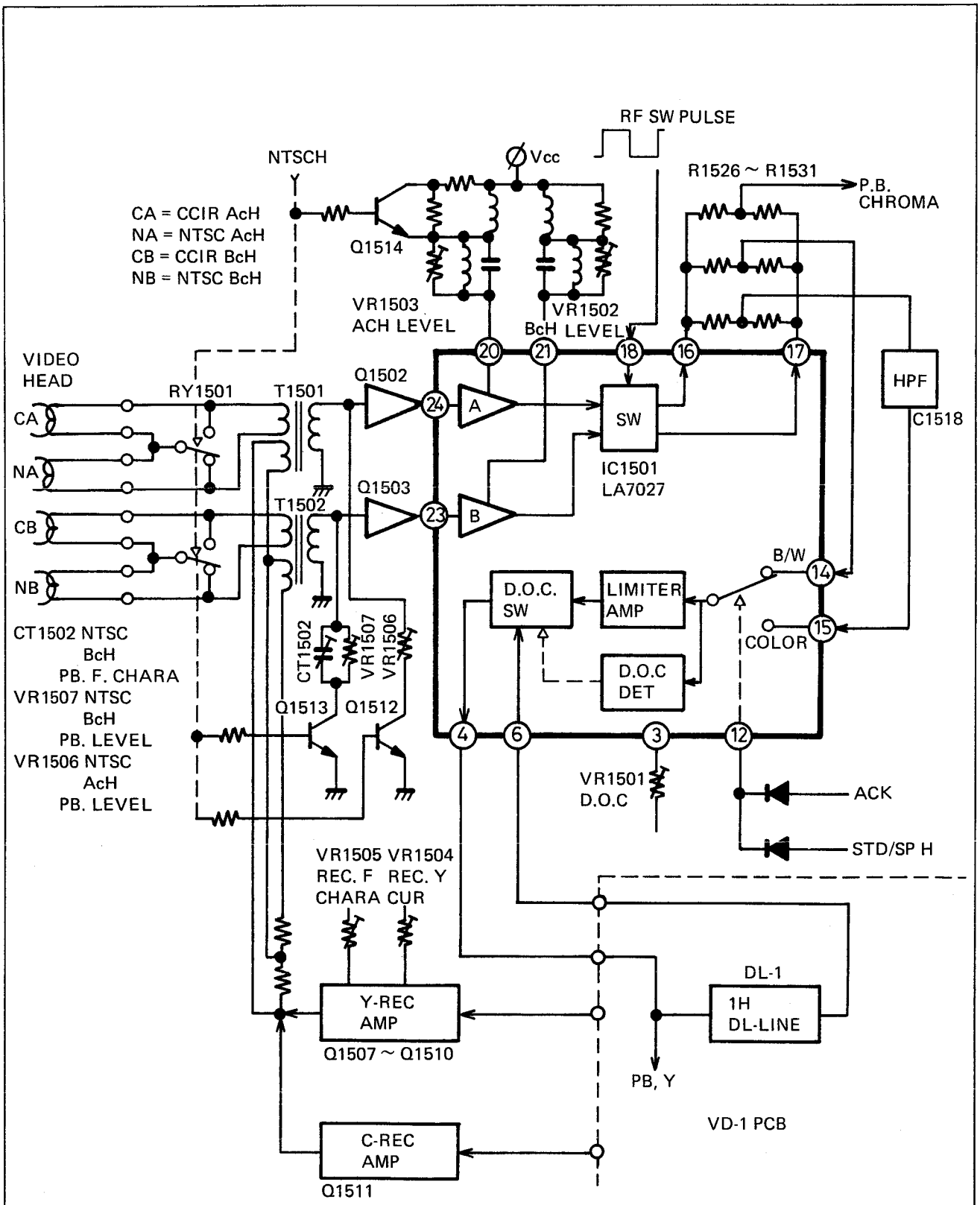


Fig. 6-1-2 L1TK VP-1 BLOCK DIAGRAM

(2) Y SYSTEM (VD-1)

1. EE SYSTEM (Fig. 6-1-3)

First, the complex video signals input to the VIDEO IN terminal are terminated (75 ohms), and are separated into two. One goes (for C recording) to the VD-2 printed-circuit board, and the other passes through the error-recording-prevention circuit (IC1 TA7347P). (If, for example, the system switch is set to a position other than NTSC 3.58 while NTSC signals with a carrier frequency of 3.58 MHz are being input, this error-recording-prevention circuit activates the ACK operation at the TV side in order to indicate that the VTR's system switch is set to the incorrect position, or, in the same way, also activated the ACK operation if the system switch is set to the NTSC 3.58 position when the carrier frequency is 4.43MHz.) After the signals pass through this circuit, they are input to IC2 TA7693P pin (5), AGC (SYNC AGC and PEAK AGC) are applied, and are output to pin (11) and pin (10). The pin (11) output is input, as signals for sync separation, to IC5 TA7357AP. The pin (10) output is input to IC6 TA7350P pin (4), sync tip clamping is applied, the signals pass through the VD drive-in circuit (during special playback), and are output from pin (6). Then drive for line out, drive for camera monitor, and drive for converter take place at Q42, Q47 and Q43, respectively.

There is, in the converter drive circuit, the Q49 sync extension circuit, which compensates for sync contraction in the converter circuit. At the same time, test signals produced at IC7 BA7004 pass through Q50 and are applied to the converter output.

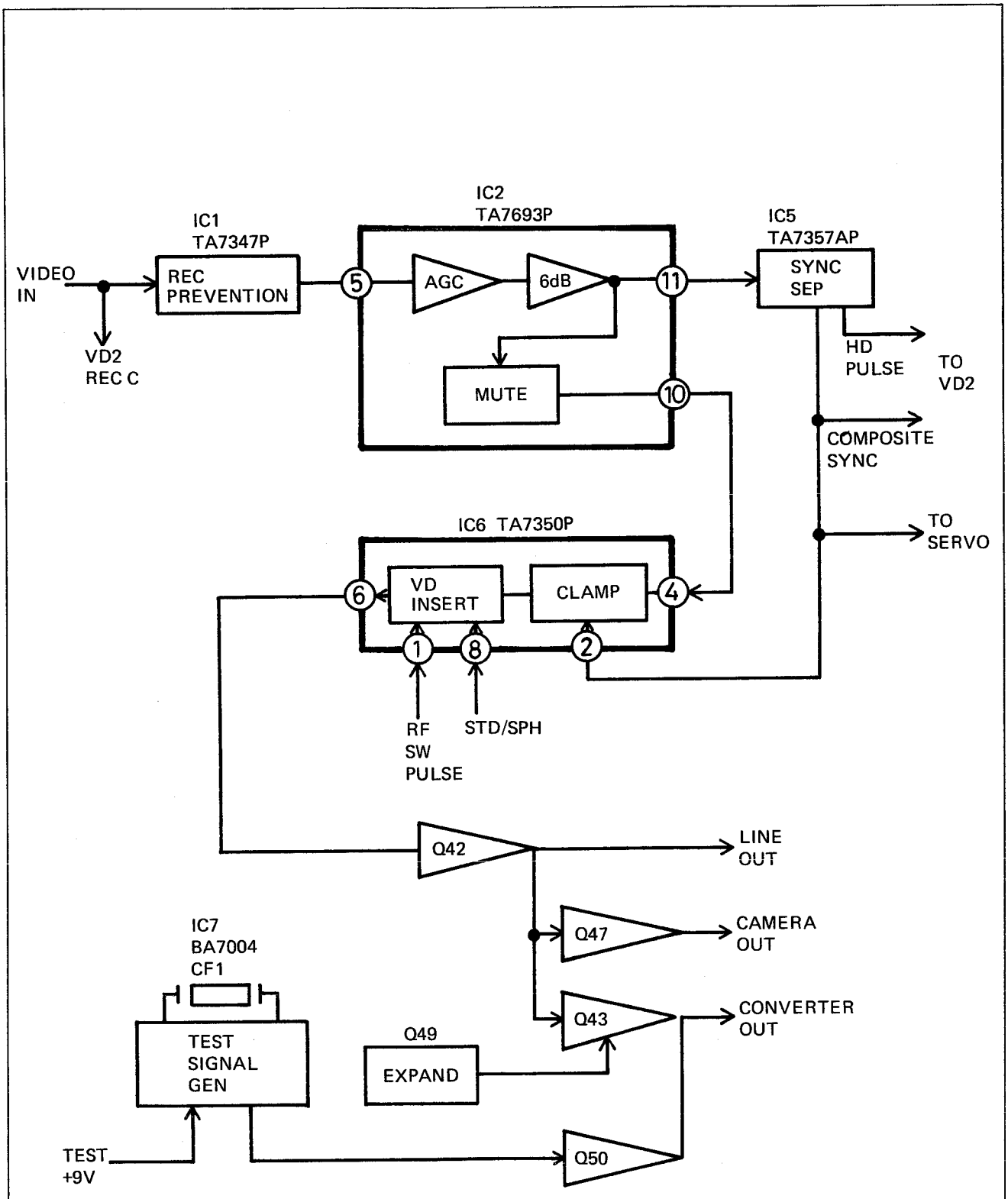


Fig. 6-1-3 Y SIGNAL (VD-1) EE BLOCK DIAGRAM

2. RECORDING SYSTEM (Fig. 6-1-4)

First, the complex video signals are input to the VIDEO IN terminal, and are input therefrom to the error-recording-prevention circuit (IC1 TA7347P). They then pass through the IC2 TA7693P pin (5) AGC amplifier, and are output from pin (3).

There are two types of AGC: peak AGC and sync AGC. Peak AGC is controlled by VR4, connected to pin (29), and sync AGC is fixed. The chroma component is eliminated, by LPF3, from the signals output from IC2 pin (3).

Switching (3.58 and 4.43MHz) is performed at transistor Q15. First, when NTSC 3.58-MHz signals are being input, Q15 is switched OFF, the LPF range becomes approximately 0 – 8MHz, and 3.58-MHz trap circuit functions.

When 4.43-MHz chroma signals are being input, Q15 is switched ON, the LPF range becomes approximately 0 – 3.2MHz, and the 4.43-MHz trap circuit functions. The signals from which the chroma component was removed by LPF3 are amplified by Q29, and are divided into two. One of these, as the AGC detection signals, passes through the Q16 buffer, passes through clamp condenser C28, is input to the IC2 pin (2) clamp 1 circuit, where sync tip clamping is applied, and it becomes the signal for AGC detection.

The other signal passes through the Q17 buffer, CCIR signal deviation is adjusted by VR9, and NTSC signal deviation is adjusted by VR10. VR9 and VR10 are selected by switching circuit Q10. After that, the signal passes through buffer amplifier Q8, and sync tip clamping is applied, for recording, by the IC2 pin (1) clamp 2 circuit (after clamp condenser C18).

Then the signal is input to pin (15) of the switching IC (IC4 TC4053BP); the recording CCIR signal is output from pin (2), the recording NTSC signal is output from pin (1), and the signal is input to the CCIR pre-emphasis circuit and the NTSC pre-emphasis circuit respectively.

The recording CCIR signal, input to the pre-emphasis circuit consisting of Q7, 9, 2, 1 and 3, is adjusted by VR6 (carrier set), VR1 (dark clip), and VR7 (white clip). It is then input to the IC2 pin (27) compression circuit, compression is adjusted by VR5, connected to pin (28); it passes through the Q18 buffer circuit, and is then input to the IC for switching, IC4, pin (5).

The recording NTSC signal, input to the pre-emphasis circuit consisting of Q11, 14, 13, 31 and 30, is adjusted by VR8 (carrier set) and VR11 (white clip); it passes through the Q53 buffer circuit, and is input to the IC for switching, IC4, pin (3).

The NTSC and CCIR signals, which have been subjected to pre-emphasis and input to pin (3) and (5) respectively of the IC for switching (IC4), are respectively selected by the pin (9) control signal, and are output from pin (4). After that, they are input to IC2 pin (25), are FM modulated, and are output from pin (19).

The pin (19) output signals pass through the 688-kHz trap circuit, are once again input to IC2 pin (18), are amplified, and are output from pin (16). They then pass through buffer Q4, and are input to the VP-1 printed-circuit board as recording Y FM signals.

Note that the FM modulation sensitivity is determined by R20, connected to IC2 pin (24), and by C12, connected to pin (21) and pin (22).

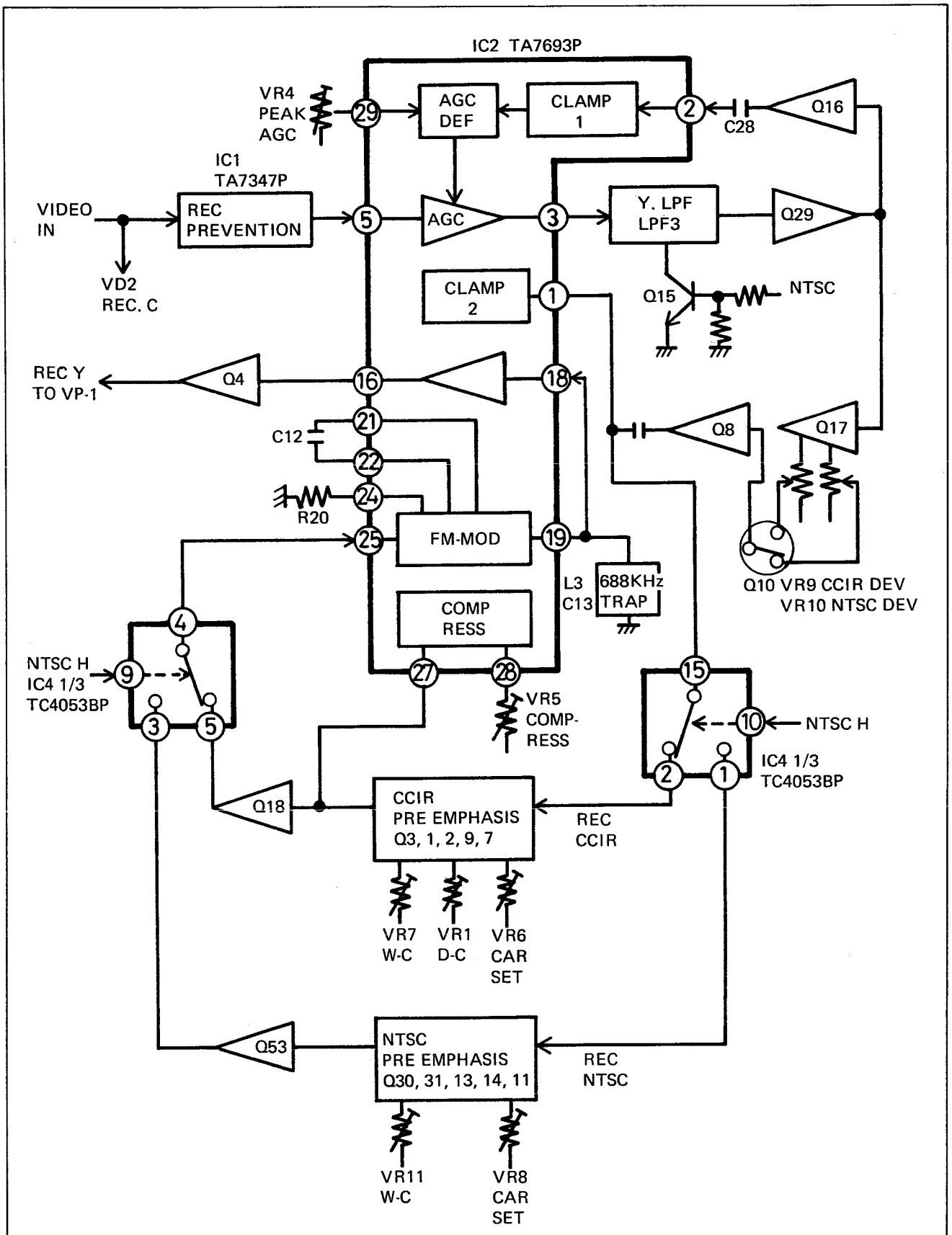


Fig. 6-1-4 Y SIGNAL (VD-1) REC BLOCK DIAGRAM

3. PLAYBACK SYSTEM (Fig. 6-1-5)

First, the playback Y FM signals from VP-1 are input to buffer amplifier Q6, and are then divided into two: the signals which enter the DL-1 1H delay line, and the signals which enter the IC2 pin (26) ma
FM signals input to DL-1 pass t
and are divided into two once
returned, for D.O.C., to the V
The other is input, for Y-comb
the IC3 LA7013 pin (15) sub-d
The Y FM signals input to
demodulated; are output from
LPF 2; pass through buffer an
and are input to the IC
cancellation (IC3) pin (7).
The Y FM signals which have
line and have been input to t
demodulated, are output fro
LPF1 and amplifier Q5, an
During this course, they pa
noise cancellation). The sig
Y-comb-type noise-cancellati
IC3 pin (1), pass through e
buffer amplifier Q39, pass th
circuit and VR14 (the NTS
ment VR0, and are divided
emphasis circuit.
Here the Y-comb-type n
inhibited, during NTSC playl
DL-1 uses the 64μsec for CCI
The following is an explanat
circuit.
This circuit is composed of
and 25, and in its path the expand is adjusted by VR13, and the CCIR playback level id adjusted by VR12. The signal then passes though buffer Q36 and is input to analogue-switching IC8 LA7016 pin (7).
The NTSC de-emphasis circuit is composed of transistors Q34, 33, 27 and 28. The NTSC Y signals, which have passed through the de-emphasis circuit and have been returned to the original signals, pass through buffer Q32, and are divided into two: to analogue-switching IC8 pin (2) and to DL4. Here, in order to align the Y/C time differences of each signal during playback, analogue-switching IC4, IC8 and DL2 (600 nsec.), and DL4 (270 nsec.) are used. The following is an explanation of the route of each signal.
CCIR: Q36 → IC8 pin (7) → IC8 pin (4) → DL2 (600 nsec.) → IC4 pin (13) → IC4 pin 14.
NTSC 4.43: Q32 → IC8 pin (2) → IC8 pin (4) DL2 (600 nsec.) → IC4 pin (13) → IC4 pin (14).
NTSC 3.58: Q32 → DL4 (270 nsec.) → IC4 pin (12) → IC4 pin 14.

T
g
y
through
input to IC3 pin (8).
ough VR3 (a VR for
which have passed the
circuit are output from
lization circuit Q40 and
igh the CCIR de-emphasis
.58 playback level adjust-
nto two in the NTSC de-
se-cancellation circuit is
ack, by Q52. This is because
3.

nals which have passed through 6-dB amplifiers
d 51 and through VR2 (the VR for NTSC 4.43
k level adjustment) are input to IC2 pin (3), are
with the PBC signals input from IC2 pin (13),
e output from IC2 pin (10) and pin (11).
that, they are output to each output terminal by the
path as the EE routed shown in Fig. 6-1-3.
that, only during special playback modes (still and
re search), VD is injected by IC6 TA7350P shown in
6-1-3.

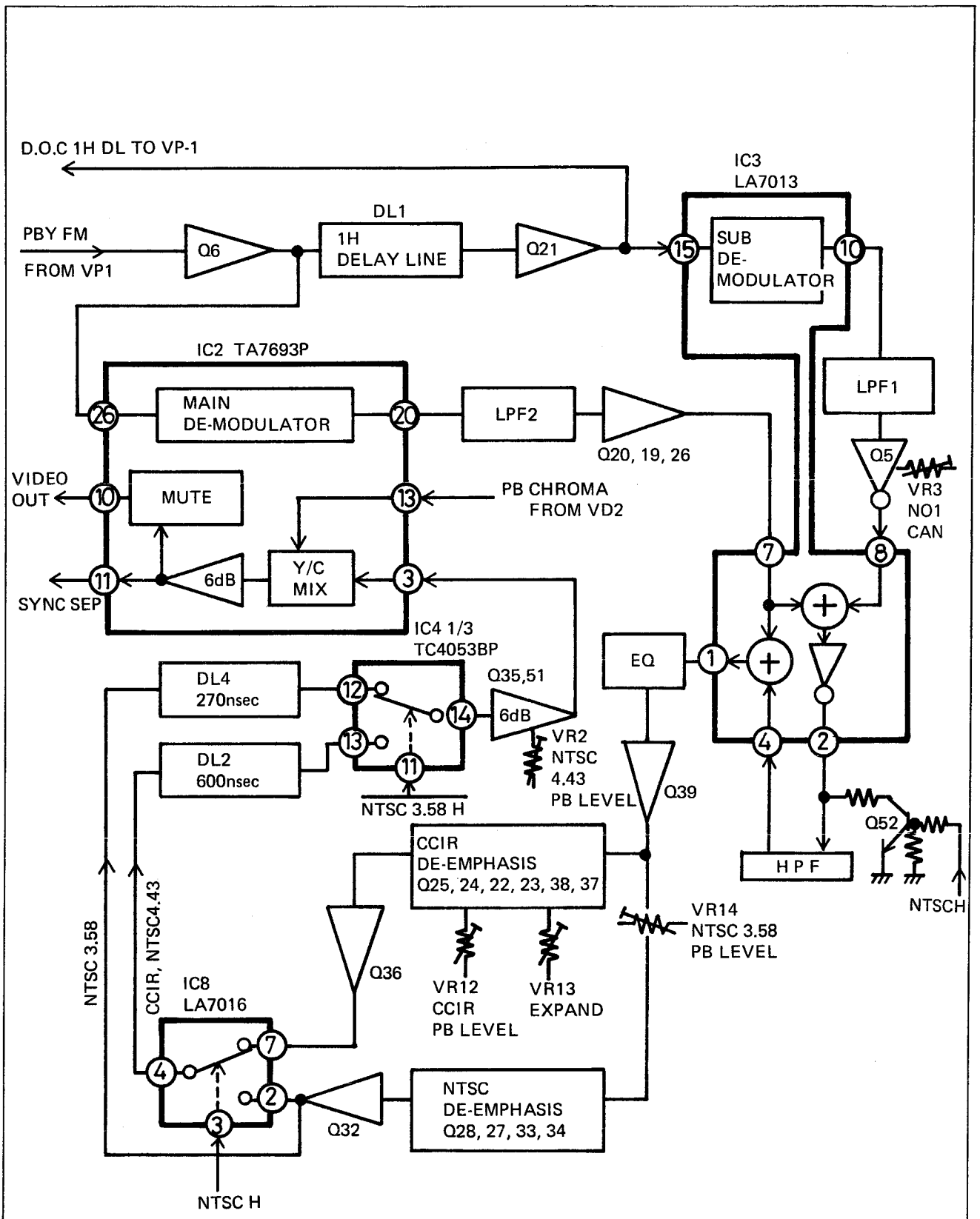


Fig. 6-1-5 Y SIGNAL (VD-1) PB BLOCK DIAGRAM

(3) THE COLOUR SYSTEM (VD-2) (See Fig. 6-1-6 and 6-1-7.)

1. RECORDING SYSTEM

1-1 PAL mode

1-1-1 Low-range conversion

The PAL complex video signal enters P1 pin (2) and passes through BPF, a 4.43-MHz BPF, where the colour component, 4.43MHz ±0.5MHz, is removed. The resulting signal enters IC1 pin (5), passes through the ACC amplifier, where the amplitude is made constant, and enters the burst-emphasis circuit; but, because this circuit does not function during the PAL mode, the signal passes on without change, and appears at pin (14). Next, the signal is sent from the IC for switching (IC2) pin (6) to pin (8), but, in order that the pilot burst signal can be inserted during the horizontal sync period, from pin (3) to pin (6) becomes continuity only during that period, and the CW signal produced at the APC circuit (Fig. 2) is injected.

Next, the 5.12 + 4.43 = 9.55 (MHz) unnecessary component is removed by the LPF (trap). Q8 is OPEN during recording, and the recording colour signal is led to P1 pin (7). This signal passes through VD-1, is mixed with the luminance signal, which has been FM-modulated by the recording amplifier (VP-1), and the resulting signal is supplied to the video head.

1-1-2 Formation of the idler signal (5.12 MHz)

The idler signal is used for low-range conversion of the 4.43-MHz colour signal to 0.69MHz. It is the carrier signal for frequency conversion, and is formed of the sum of the (44 ±1/8)fH = 0.69-MHz frequency locked to the horizontal frequency (the ± tolerance is switched to correspond to heads B and A), and the CW signal locked to the 4.48-MHz input colour-burst signal; in other words, it is formed as 0.69 + 4.43 = 5.12MHz (Fig. 2).

The horizontal-sync pulse (HD), which was separated from the recording video signal, enters P2 pin (5) from VD-1. The signal from IC3 5.5-MHz VCO output pin (12) is input to IC12 pin (6). This is count down to 1/351 and/or 1/353 by the head-switching pulse (RF SW1-P), is input to IC3 pin (18), is compared with pin (17) HD, and the 5.5-MHz VCO center frequency is regulated so that both differences are the same phase. This signal is count down to 1/8, and enters the sub-converter. In the sub-converter, the 4.43-MHz CW signal locked to the input chroma signal is supplied, but this will be explained at the latter part of this section.

Because the 5.5/8 = 0.69MHz and 4.43MHz sum and difference 5.12MHz and 3.74MHz are output from the sub-converter to pin (2), the 5.12-MHz component only is taken out by CF2 (a 5.12-MHz ceramic filter), the signal enters the inversion circuit (P1 circuit) – IC3 pin (4), but through in the PAL mode, and enters the main converter, without change, as the idler signal.

The 4.48-MHz CW signal is former ows. The output of the IC1 ACC amplifier passes R/P switching, enters the burst gate, and ente hase comparato (PC). The IC10 VCO output (pir ters IC1 pin (15 and, after passing through the sw entering the 90 shifter, becomes the other com input of the PC mentioned above.

After noise is removed from th voltage Ve of pin (18) by the loop filter (C408, F nd C305), the VCO is controlled by the resulting sig this way, the VCO appears in the IC1 ACC amplifie ut, and locks to the phase of the burst signal.

1-2 SECAM mode

1-2-1 Low range conversion

Recording video signals enter P1-2, the luminance signal is eliminated by BPF-2 (4. 1Hz), and the resulting signals enter IC1 pin (5). Th xed amplitude colour signal from IC1 pin (14) enters Q33 bell filter, and the amplitude is flattened. The sign hen passes through Q28 and 29 switching, and, by I switching, the present signal and the 1H prior signal, hich has passed through DL2, are alternately switched very other frame. Next, the signal enters IC2 pin (1), a passes from pin (8) into pin (6) of the main converter, a ter which it is recorded in the same way as for the PAL ode. During SECAM, the colour recording current is set o 2/3 that of PAL in order to prevent mixed modulation with Y.

1-2-2 Formation of the idler signal

During SECAM, the APC operation is stopped. The burst gate is closed by Q37, and the VCO frequency is fixed. Otherwise, the operation is the same as for the PAL mode.

1-3 NTSC mode

1-3-1 4.43-MHz NTSC recording system

The P1-2 recording video signals pass through BPF2 (4.43 MHz), enter IC1, and, during the βIII mode, the burst is increased 6dB by the burst emphasis. Next, the signals are subjected to low-range conversion by the IC3 main converter, and signal processing from pin (8) is in the same way as for the PAL mode.

APC is the same way as for the PAL mode. As for AFC, the counter is switched to 1/70 from IC12, and a (44-1/4) fH carrier is input to the sub-converter. Signals pass from IC3 pin (2), through a 5.12-MHz ceramic filter, and enter the inversion circuit. Here the phase of channel A only is inverted. Because, as a result of this, the main converter output is (44-1/4) fH and because the phase of only channel A is inverted every H, there is frequency interleaving between the tracks.

1-3-2 3.58-MHz NTSC recording system

P1-2 recording video signals pass through BPF2 (3.58MHz), pass through D7, and enter IC1 pin (5). Subsequent processing is the same as for the 4.43-MHz mode. The APC switches the crystal to 3.58MHz (X1),

and the VCO oscillator (ceramic filter) also is switched to 3.58MHz (CF5). The operation is in the same way as for PAL/4.43 NTSC.
Because the idler frequency becomes 3.58MHz + 0.69MHz = 4.27MHz, it is passed through CF1 (4.27MHz).

2. PLAYBACK SYSTEM

2-1 PAL mode

2-1-1 High-range conversion

After the low-range conversion chrominance signals played back from the tape pass from P1-3 through the LPF and the luminance signals have been eliminated, they enter IC1 pin (6).
Then, after the amplitude has been made constant by the ACC amplifier, they pass from pin (14) through IC2 switching, and enter the IC3 main converter (pin (6)).
During playback, 5.12MHz − 0.68 (0.69???) MHz = 4.43MHz high-range conversion is effected by the idler signal, and the resulting signals are output from pin (10). Because a 5.12MHz + 0.68MHz = 5.8MHz unnecessary component is present in this output, this is eliminated by BPF-1 (a 4.43-MHz BPF). The signal next passes through a switch composed of Q28 and 29, and enters a comb-type filter composed of DL2 and DL3. Here the crosstalk component from the adjacent track is eliminated, the signals enter IC5 pin (1), and are supplied to IC1 pin (27). Within the IC, inversion is effected by the reverse circuit when the phase is non-continuous, the APC pull-in time is shrotened, and the colour phase is thus stabilized. Next, the signals pass through the R/P switch inside the IC, and enter the ACK circuit. Here the presence of the colour signal is detected, colour-killer (ACK) voltage and the playback colour signal are added to pin (24), and the signals are output. The colour component is eliminated at the LPF (R475 and C436), and ACK control voltage can be obtained.
This voltage is used to cut-off output during black-and-white playback (pin (10); pin (8) during recording) from the main converter (IC3 pin (9)). The output of IC1 pin (24) passes through IC7 switching pin (6) − pin (8), and enters IC8 pin (21). IC8 (M51439P) is a colour-sequence-correction circuit during PAL special playback modes; corrected playback output from pin (27) is supplied to P1-10, enters IC2 pin (13) of VD-1, and is mixed with the playback luminance signal.

2-1-2 APC and AFC circuits

The AFC during playback is processed in the same way as during recording, with the exception of the fact that the IC3 phase comparator pin (17) input is the playback luminance signal; the (44 ±1/8)fH carrier is supplied to the IC3 sub-converter. (fH is the playback horizontal frequency, and includes the jitter component ΔfH.)
The APC during playback regulates the VCO (IC10) so that the frequency/phase of the high-range converted colour sub-carrier is locked to the oscillation frequency/phase of the reference oscillator (IC11). In other words, the played back pilot burst signal is pulled out at the IC1 burst gate, and the output of the reference oscillator is compared with the 90° phase-shifted carrier. (IC1 P.C.)
Both phase-error outputs Ve are obtained at pin (18), enter IC10 pin (2), and regulate the VCO center frequency.
Consequently, the 4.43-MHz + ΔfR jitter component is included in the VCO output (pin (7)). This is input to the IC3 sub-converter (pin (1)), and the 5.12-MHz idler signal is obtained. In brief, then, the ΔfH and ΔfR components are cancelled at the main converter, and jitter is not included in the high-range conversion output.

2-1-3 AFDR

The AFDR suppresses drift of the VCO oscillation frequency; it compares the frequency of the reference oscillator and the VCO frequency, and, when there is a deviation which exceeds the fixed limit, AFDR error voltage is supplied from IC11 pin (2) to the VCO (IC10) pin (1) in order to prevent fluctuations of the frequency.

2-1-4 ACC and ACK circuits

The ACC circuit functions to make the burst amplitude constant during recording, passing the output of the ACC amplifier through the R/P switch, taking out and detecting at the burst gate, and thus controlled the ACC amplifier. All of this is done within IC1.
Because the ACC takes out the IC1 pin (27) burst signal during playback, the pin (21) colour level is always regulated to a constant fixed level.
The ACK circuit is the sync-detection type; it detects by using the carrier which enters the phase comparator, and, if this carrier and the burst during the playback colour signal are not locked, the pin (24) DC level is dropped to 0V as the B/W mode. The chroma component is eliminated by R475 and C436, and killer voltage is obtained.

2-2 SECAM mode

2-2-1 High-range conversion

The output of the ACC amplifier passes from IC1 pin (14) to IC3 pin (6), and enters the main converter; the output converted to high-range (4.3MHz band) passes from IC3 pin (10) through the 4.43-MHz BPF, passes through Q29, and enters DL2; then there is frame switching of the present signal/1H delayed signal, the same way as during recording, and colour sequence is recovered. The signals next pass through IC5 and enter IC1 pin (27). The inversion circuit (burst ID) is inhibited during the SECAM mode, and the signals pass through the R/P switch with IC1 and enter the ACK circuit.
The ACK circuit is also inhibited, and is activated by the output voltage of the SECAM mode detection circuit, described later. The output of IC1 pin (24) widens the band, by the D19 and 20 limiters, and thus prevents tearing. After that, the unnecessary band component is eliminated by the 4.3-MHz BPF (composed of L15, C370 and T3), and the signal is returned to the form of the original SECAM signal by the bell filter, which is

composed of T2, C399 and R427.
The signal next passes through IC7, IC7 (through during SECAM mode), and enters the VD1 Y/C mixing circuit.

2-2-2 Idler

In the same as during recording, the APC does not operate. A 5.12-MHz idler signal is produced by using the VCO free oscillation and the AFC's (44 ±1/8)fH.

2-3 NTSC

2-3-1 4.43-MHz mode

The ACC output passes from IC1 pin (14) through the IC3 main converter, is up-converted to the 4.43-MHz band, passes through BPF-1 and Q29, and enters DL2. The signal to which the DL2 output has been added enters IC4 pin (1), and it functions as a comb-type filter.
The output of IC5 enters IC1 pin (27), and, after the phase is stabilized by the burst ID circuit, it is output from pin (24), passes through IC7 pins (6) through (8), passes through IC8, and enters the Y/C mixing circuit.
The idler is 5.12MHz and the APC loop functions so that the playback burst will be locked to the 4.43-MHz reference oscillator (X2). The AFC frequency which enters the sub-converter is (44-1/4)fH, and the counter within IC12 is set to 1/70. The idler signal, which has passed through CF2, enters the inversion circuit from IC3 pin (4), and, in the same way as for recording, 1/2fH phase inversion occurs at each field.

2-3-2 3.58-MHz mode

IC1 pin (14) ACC output passes through the IC3 main converter and the 3.58-MHz comb-type filter (DL4), enters IC5 via BPF-1 (3.58MHz), and then enters IC1 pin (27). Subsequent processing until Y/C mixing is the same as for the 4.48-MHz mode.
The idler is 4.27MHz and the APC functions so as to lock the playback burst at 3.58MHz (X1). Other than that, the processing is the same as for the 4.43-MHz mode.

3. PAL special playback correction circuit (IC8)

This circuit spans the tracks during special playback modes, and, at the place where there is switching to the next same-channel track signal, the PAL burst-phase signal becomes non-continuous. In addition, when noise bars appear due to signals of other channels, there may be colour fading if the TV set's chroma signal is insufficient. It is in this instance that this IC replaces the colour burst. The present signal enters IC8 pin (21), and the 1H-before signal enters pin (19); then, when there is non-continuance of the phase, there is switching to the other so that continuity is recovered. Burst phase detection is done by employing the ID detection signal from pin (24) for comparison of the pin (5) and (6) CW.
Signals with a 90° opposing phase, produced from the reference oscillator (IC11) during playback are input to pins (5) and (6). Because these are switched at 1/2-fH intervals, fH VCO is created at pins (8) – (13).

4. SECAM-mode-detection circuit (IC9)

During recording, ACC output enters IC9 pin (1), and, during playback, high-range converted colour s enter. The burst is taken out by the pin (2) BG), d the signal passes from pin (3) through the Q ir and enters the narrow-band filter composed id CF4. CF3 and CF4 permit only the 4.25-MHz nt to pass, attenuating the SECAM 4.41-MHz nt and the PAL 4.43-MHz component. This is i in (7), detected, and tuned to 6.8kHz by th ice circuit consisting of T1 and C326. Because AM 4.25-MHz and 4.41-MHz H-ID signals get on ack porch at each H interval, the filter described a ised to attenuate the 4.41-MHz component, s t the 7.8-kHz component can be obtained. This ponent does not appear for PAL. The DC voltage w letects this 7.8-kHz component is obtained from pir and is used as the control signal during SECAM.

5. Logic circuitry (IC13 and IC14)

This circuitry produces a control signal for -1/VD-2 circuit switching to correspond to the colo ignals of each of the broadcast standards.

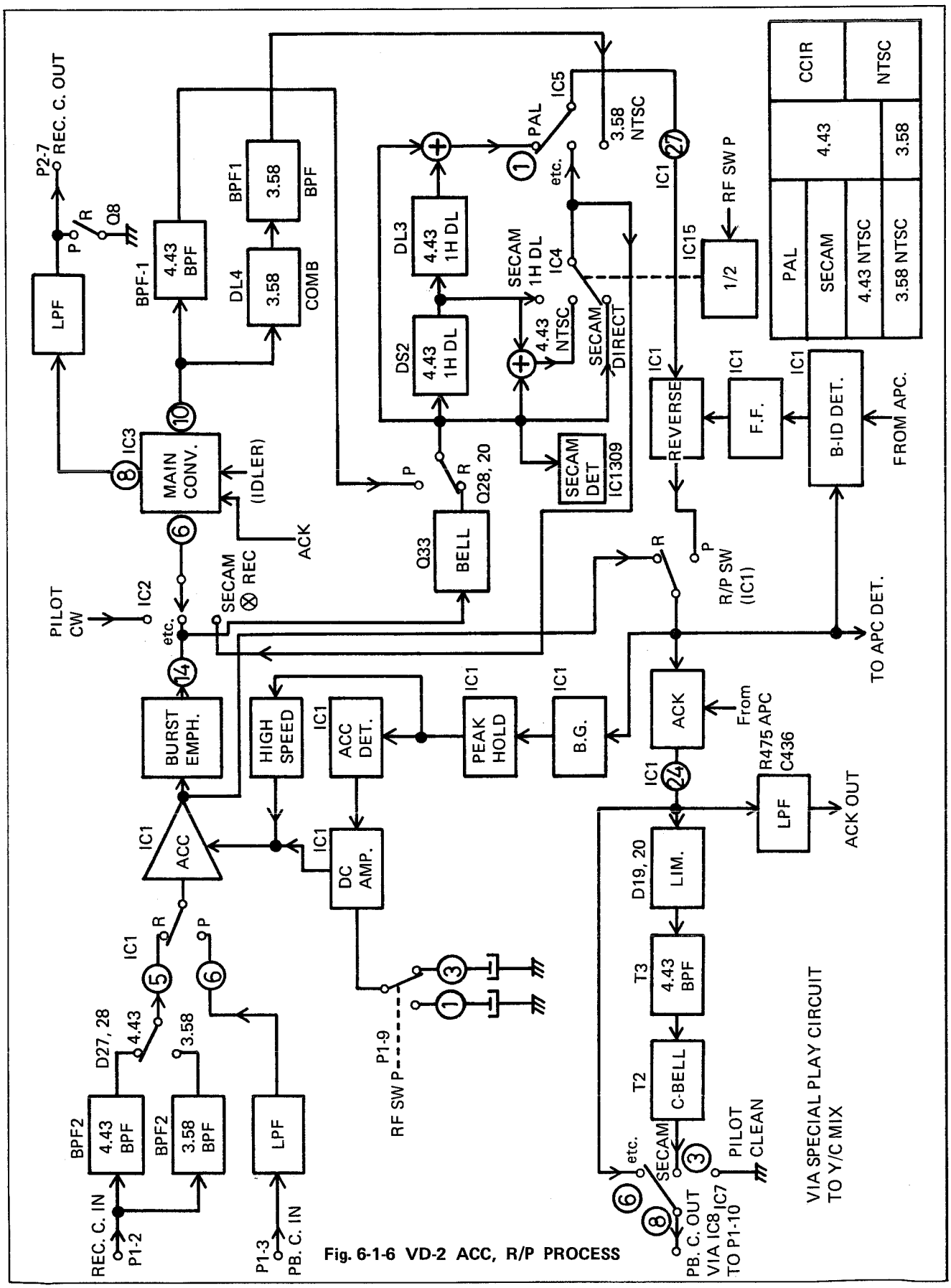


Fig. 6-1-6 VD-2 ACC, R/P PROCESS

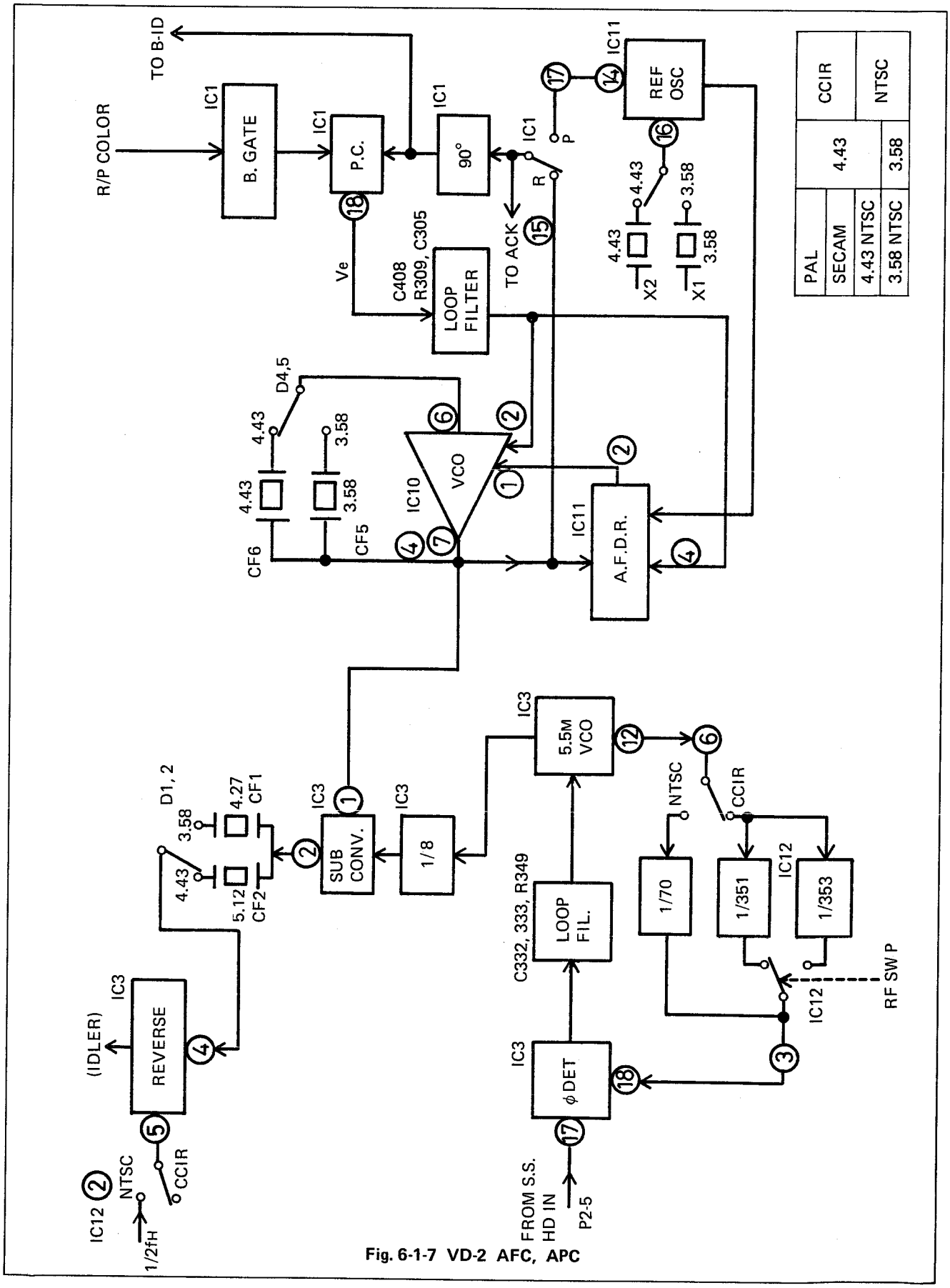


Fig. 6-1-7 VD-2 AFC, APC

B. SERVO CIRCUIT

I. OUTLINE

The servo circuit is composed of two printed-circuit boards: SV-1 and SV-4. The SV-1 board mainly controls the phase and speed of MH, and the SV-4 board mainly controls the phase and speed of MC.

Because there is recording and playback in both the PAL/SECAM (hereinafter referred to as PAL) and NTSC modes, there are 4 heads, 2 for PAL and 2 for NTSC. As a result, because it is a 4-head, 4-system compared to the existing conventional type, switching circuits have been added. The 4-head positional relationship is as shown in the figure. There is an NTSC head in the normal head position, and a PAL head in the position 45° away from it.

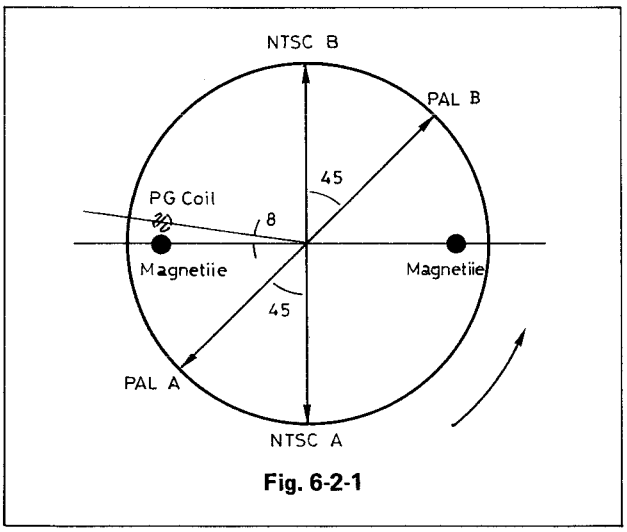


Fig. 6-2-1

1. Head motor servo circuit

The phase and speed of the head motor are mainly controlled by the SV-1 printed-circuit board IC4001 (CX186). The speed of the head motor is controlled by the PG signal (NTSC: 30 Hz, PAL: 25 Hz) and, at the same time, during recording, the phase of the PG signal and of the vertical sync signal are compared and the rotational phase of the head motor is controlled to a certain value. During playback, the phase of the reference signal (NTSC. 60 Hz, PAL. 50 Hz) obtained from the 31.25-kHz signal is compared, and the rotational phase of the head motor is thereby controlled to a certain value.

2. Capstan servo circuit

The phase and speed of the capstan servo are mainly controlled by the SV-4 printed-circuit board IC4401 (CX143A). The speed of the capstan motor is controlled by the GF signal. During normal recording, the phase of the FG signal and of the vertical sync signal are compared. During playback, the phase of the CTL signal and of the reference signal (obtained from the 31.25-kHz signal) are compared, thereby maintaining the rotational phase of the capstan motor at a certain value.

For this model, only NTSC recording is different from normal: the phase servo is not applied by the vertical sync signal, it is applied by the reference signal.

The capstan phase servo of this unit is applied by the FG signal and the vertical sync signal during PAL recording, by the FG signal and the reference signal during NTSC recording, and by the CTL signal and the reference signal during PAL playback and NTSC playback.

The only special playback mode of this unit is picture search. During picture search, in addition to the change of the capstan rotation (to 5X for PAL and to 7X for NTSC), the head motor rotation is also changed so that the horizontal sync signal of the playback video signal becomes, during picture search, 15.625 kHz (for PAL) and 15.734 kHz (for NTSC).

The functions of the SC-1 and SV-4 ICs are as described below.

IC4001 (CX186, SV-1) . . . head motor phase and speed control circuit

IC4002 (TC4051BP, SV-1) . . . VR switching circuit for head motor speed switching

IC4003 (BA6305, SV-1) . . . CTL amplifier and waveform-shaping circuit

IC4004 (MSM5240RS, SV-1) . . . reference-signal generation circuit

IC4005 (TD62007P, SV-1) . . . mode production circuit

IC4401 (CX143A, SV-4) . . . capstan motor and phase circuit

IC4402 (TC4051BP, SV-4) . . . VR switching circuit for capstan motor speed control

IC4003 (BA6305, SV-4) . . . FG amplifier and waveform-shaping circuit

IC4404 (TC4520BP, SV-4) . . . FG pulse-division and waveform-shaping circuit

IC4405 (TC4016BP, SV-4) . . . FG CTL switching circuit

IC4406 (TC4520BP, SV-4) . . . CTL pulse and reference signal division circuit

IC4407 (LC7401, SV-4) . . . βII/βIII recognition and FG amplifier division circuit

II CIRCUIT OPERATION

1. Head motor control circuit

(1) Video head switching pulse made from PG pulse

The PG coil and magnet are used for detection of the rotation speed and rotation position of the video head. Their positional relationship is shown in Fig. 1.

When the NTSC video comes, as the video head disc rotates, to a position approximately 8° before the switching position, the PG-A pulse and PG-B pulse are generated. Because the PAL video head is located, as can be seen in Fig. 1, in a 45° delayed position in relation to the NTSC head as it moves in its direction of rotation, the PG pulse is generated 53° (45° + 8°) before the switching position. Fig. 2 shows the process by which the video head switching pulse is formed.

The PG pulse generated from the cylinder is input from S4002 pin (2) to the SV-1 printed-circuit board, and is applied to IC4001 pin (1). After the PG pulse is amplified at PG-1A and PG-B detection, a 25-Hz (PAL) or 30-Hz (NTSC) square wave is formed at (FF1). This square wave is supplied to switching position delay B and is also sent to (speed M1) and (gate pulse 2) of the speed control circuit. The (FF1) square wave is delayed for 0.74 ms (1/30 x 360° x 8) for NTSC, or 5.89 ms (1/25 x 360° x 53) for PAL, by (switching position delay B) and (switching position delay A), thus correcting for the mechanical error of the PG coil installation position. The NTSC head and PAL head delay amounts (angle) are adjusted by changing the constants of the external resistances of pins (2) and (3).

At pin (2) during NTSC for example, Q4001 functions and +B is connected to VR4002, and, during PAL, Q4001 is switched OFF, and +B is connected to VR4002 through VR4001. (Pin (3) is the same.)

The B head operates for the high-level interval of the video head switching pulse (RF switching pulse) output to pin (4) of IC4001, and the A head operates during the low-level interval.

(2) Speed control applied to head motor

The circuit which increases the rpm until phase servo is applied to the DC motor, and then maintains that rpm, is the speed-control circuit.

For this model, IC4001 includes the head motor speed-control circuit. From the operation of this circuit, the signal which becomes the reference signal is the PG pulse which indicates the rotation phase of the head.

The PG pulse input to pin (1) of IC4001 is formed into a square wave at (FF1), is delay by (speed MM1), and is formed into a trapezoidal wave by (slope 1). In addition, the gate pulse of the PG-B pulse is made at (FF1) and (gate pulse 2) (IC4001 pin (23)). This gate pulse and the trapezoidal wave pass through (gate 2); this gated voltage is held by (hold 2), and, after current amplification, is sent from Q4004 pin (18) to the head motor drive circuit.

For this model, because the servo circuit response is different for NTSC and for PAL/SECAM, a capacitor is added so that, during PAL, the slope of the trapezoidal wave of pin (22) is changed by Q4007.

The slope of pin (24) is changed in order to change the speed. The switching for PAL and for NTSC is accomplished, by IC4002, by the resistance connecting pin (24) to +B.

As for (starter 1), preparation time begins from the moment that the trapezoidal waveform begins at (MM), and reset is applied at the moment when the next reset pulse is generated.

If the motor rpm is low, reset is applied so that, for a period of stability, the circuit constant is selected. When (starter 1) reaches a stabilized condition, high voltage is output to pin (18) so that, when the motor rpm is low, the motor is driven compulsorily and servo is quickly applied.

(3) Head motor phase control

The head motor phase control, during recording, synchronizes (synchronization: the time point at which the video head traces a position on the tape 7H before the vertical sync signal leading edge of the video signal) the rotation phase of the video head to the video signal, and, during playback, must precisely trace, by the same head as the recording head, this recorded tape pattern.

The control head records, on the lower edge of the tape, the time point when head A begins, and, during playback, the recorded control signal is played back. Phase control is applied to the head motor so that this playback time point starts the head A trace.

Actually, because the capstan servo system is used, synchronization is, during playback, to the reference signal produced by the (crystal) and the (frequency-division circuit). The playback CTL signal is supplied to the capstan servo circuit, and the tape speed is controlled so that the reference signal and the phase agree. As a result, with the reference signal as an intermediate, the video head rotation phase is synchronized with the playback CTL signal.

Next, the block diagram will be used for explanations.

During recording,the vertical sync signal of the video signal input from S4001 pin (2) to the SV-1 printed-circuit board becomes the reference signal of the servo circuit.

The vertical sync signal passes through Q4020 and is applied to IC4001 pin (12). The vertical sync signal which has entered pin (12), after being subjected to noise-resistance characteristics by (MM1) of pin (13), is formed as a 25-0Hz (PAL) or 30-Hz (NTSC) square-wave by the 1/2 counter in IC4001. The signal which indicates the head rotation phase is the downslope part (the beginning of the PG-A pulse) of the video head switching pulse (RF switching pulse) made from the PG pulse, and this signal is delayed by (phase MM), passes through (gate pulse 1), becomes the gate signal, and is sent to (S & H).

The reference signal produced from the vertical sync

signal is output as a square wave from IC4001 pin (13), is integrated at slope 1, and becomes a trapezoidal wave. The trapezoidal wave is sent to IC4001 pin (7), is applied to (gate 1), and, after it is gated, held, and current amplified by the gate pulse made by the PG-A pulse, it is output from IC4001 pin (10).
This signal passes through Q4005 (buffer), and is input to IC4001 pin (19). It is then compared to the speed control voltage, added, and is supplied from IC4001 pin (18), through S4005 pin (4), to the head motor drive circuit.
As for the phase-control method, if, for example, the motor rotation becomes faster than the reference signal, the RF switching pulse becomes delayed in relation to the reference signal. As a result, the gated voltage becomes low, and the voltage output from IC4001 pin (10) also becomes low. Then, the voltage which passes through Q4005 (buffer) and is input to IC4001 pin (19) also becomes low.
The amplifier located between pins (18) and (19) of IC4001 is a differential amplifier which amplifies the output voltage (the part amplified by the speed and phase difference), increasing it until the motor rotation matches the phase.
When the motor rotation becomes faster than the reference signal, the opposite process occurs.
During playback, the signal produced by the IC4001 crystal is used as the reference signal. The reference signal output from IC4004 pin (15) passes through Q4021 (switching), and is input to IC4001 pin (12). The circuit operation of IC4001 is the sam as during recording, except that the reference signal is different. Note that the head motor phase-lock position is adjusted by VR4005 (during PAL) and VR4006 (during NTSC) so that the position where the video head begins to scan is 7H before the leading edge of the vertical sync signal. The head motor is switched ON and OFF by the MHON signal from S4006 pin (3), and switching is by IC4005 pins (7) and (8). The motor is stopped by the servo voltage output from IC4001 pin (18) becoming low.

2. CAPSTAN SERVO CIRCUIT

(1) Capstan motor speed control
The capstan motor speed control circuit is almost the same as the head motor speed control circuit. The capstan motor has FG pulses instead of the PG pulses of the head motor. The GF pulse is input from S4403 pin (3) to the SV-4 printed-circuit board, and is applied to IC4401 pin (1).
At IC4401, after the FG pulse is amplified, it is waveform shaped, and the square wave is output from pin (6). The FG pulse of this square wave is used for capstan motor phase control during recording, and for capstan motor speed control during recording and playback.
In the speed control system,the FG pulse (square wave) is input to IC4407 pin (4). In IC4407, there is the frequency-division circuit of the FG pulse speed-control system. During FWD, there is no frequency division, but there is a 1/5 frequency division during PAL search, a 1/7 frequency division during NTSC search (βIII), and a 1/5 frequency division during NTSC search (βII). The FG pulse which passes through IC4407 and is output from pin (18) is input to IC4401 pin (13) for speed control.
After the rising and falling parts of the input FG pulse are delayed by (MM3) (speed MM2), a trapezoidal wave is made by the (slope) and is sent to the (gate circuit).
At the same time, one of the FG pulses where entered pin (13) becomes, by (MM), a gate pulse, is sent to the gate circuit (pin (6)), and the trapezoidal wave is held.
This held capstan motor servo voltage is sent first from IC4401 pin (1) to S4003 pin (5), and then supplied to the capstan motor drive circuit.
The speed adjustment of the capstan motor is made by the switching of the (speed MM) time-constant. The PAL and NTSC βIII (speed MM) time-constant adjustment VR is by switching of IC4402. NTSC βII (speed MM) switching is done after passing through Q4410, at VR4407.
In addition, the capacitor capacitance is changed by the switching or Q4402 and Q4403 so that there will be a speed change between each mode.
The starting and stopping of the capstan motor is done by dropping the capstan servo voltage of IC4401 to low by Q4401, using the Mc ON signal. Note that the capstan motor speed-control circuit is the same for both PAL and NTSC during recording and playback.

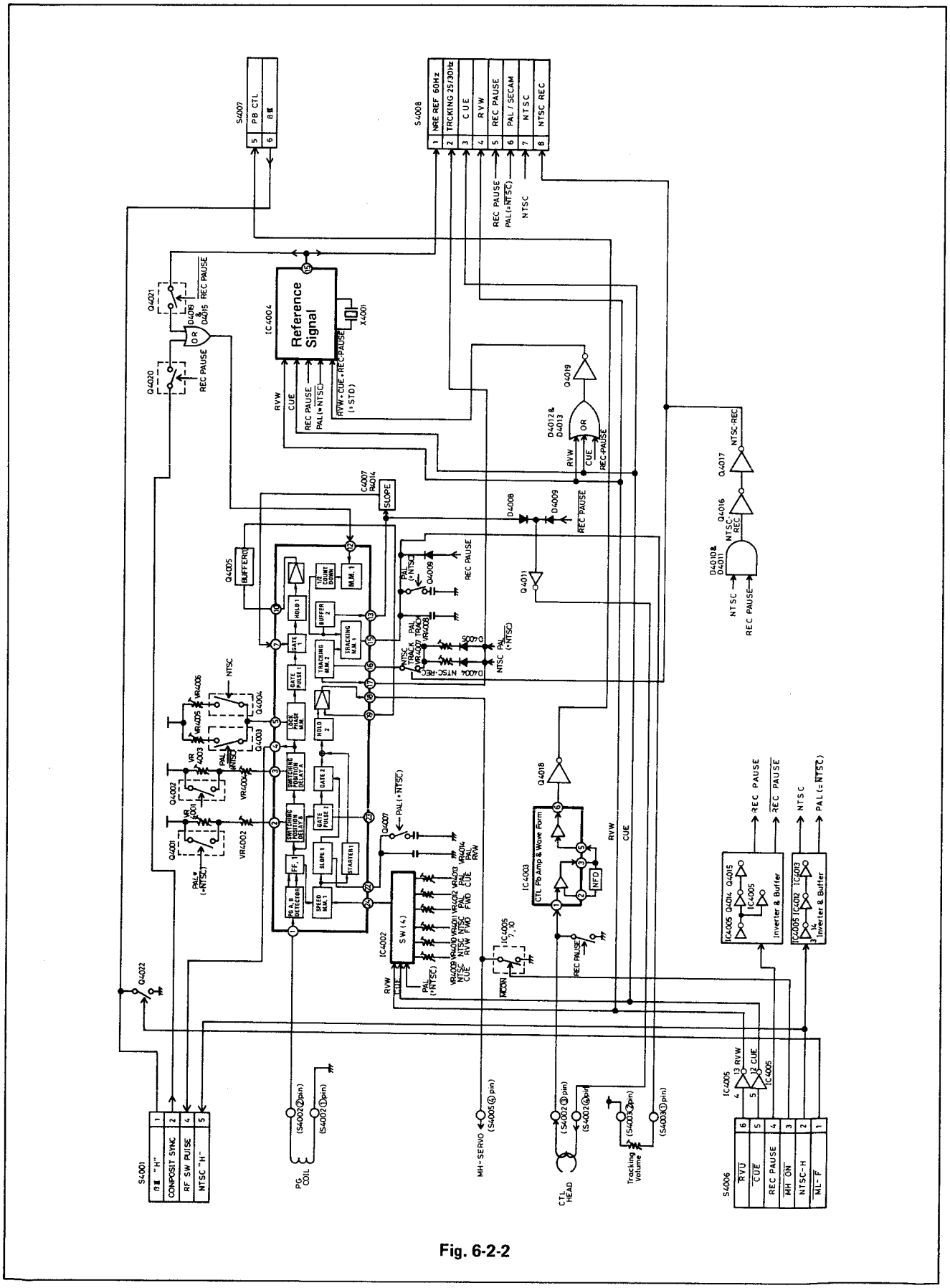

S4007
PB CTL
S4008
NRE REF 60Hz
TRCKING 25/30Hz
CUE
RVW
REC PAUSE
PAL / SECAM
NTSC
NTSC REC
REC PAUSE
PAL(+NTSC)
NTSC
IC4004
Reference Signal
X4001
RVW
CUE
REC PAUSE
PAL(+NTSC)
RVW+CUE-REC-PAUSE (+STD)
Q4021
Q4020
D4009 & D4015
OR
REC PAUSE
REC PAUSE
Q4019
D4012 & D4013
OR
RVW
CUE
REC-PAUSE
Q4017
NTSC-REC
Q4016
NTSC REC
D4010 & D4011
NTSC
REC PAUSE
C4007 R4014
SLOPE
D4008
D4009
REC PAUSE
Q4011
Q4005
BUFFER
REC PAUSE
PAL (+NTSC)
Q4009
PAL TRACK VR4007
NTSC TRACK VR4008
D4004 NTSC-REC
NTSC
PAL (+NTSC)
NTSC
VR4006
VR4005
Q4004
Q4003
VR4003
PAL NTSC
Q4002
VR4001
VR4002
Q4001
PAL (+NTSC)
Q4007
PAL (+NTSC)
Q4018
CTL Pb Amp & Wave Form
IC4003
NFD
RVW
CUE
REC PAUSE
IC4002
S W (4)
VR4009 NTSC CUE
VR4010 NTSC RVW
VR4011 NTSC FWD
VR4012 PAL FWD
VR4013 PAL CUE
VR4014 PAL RVW
PAL (+NTSC)
RVW
CUE
IC4005 7, 10
RCON
REC PAUSE
IC4005 Q4014 Q4015
IC4005
Inverter & Buffer
REC PAUSE
REC PAUSE
IC4005 IC4002 IC4003
Inverter & Buffer
NTSC
PAL (+NTSC)
Q4022
S4001
"H"
COMPOSIT SYNC
RF SW PULSE
NTSC "H"
PG COIL
(S4002 ② pin)
(S4001 ① pin)
MH-SERVO
(S4005 ⑤ pin)
CTL HEAD
(S4002 ③ pin)
(S4002 ① pin)
Tracking Volume
(S4003 ② pin)
(S4003 ① pin)
IC4005
13 RVW
12 CUE
IC4005
S4006
RVW
CUE
REC PAUSE
MH ON
NTSC-H
NL-F

Fig. 6-2-2

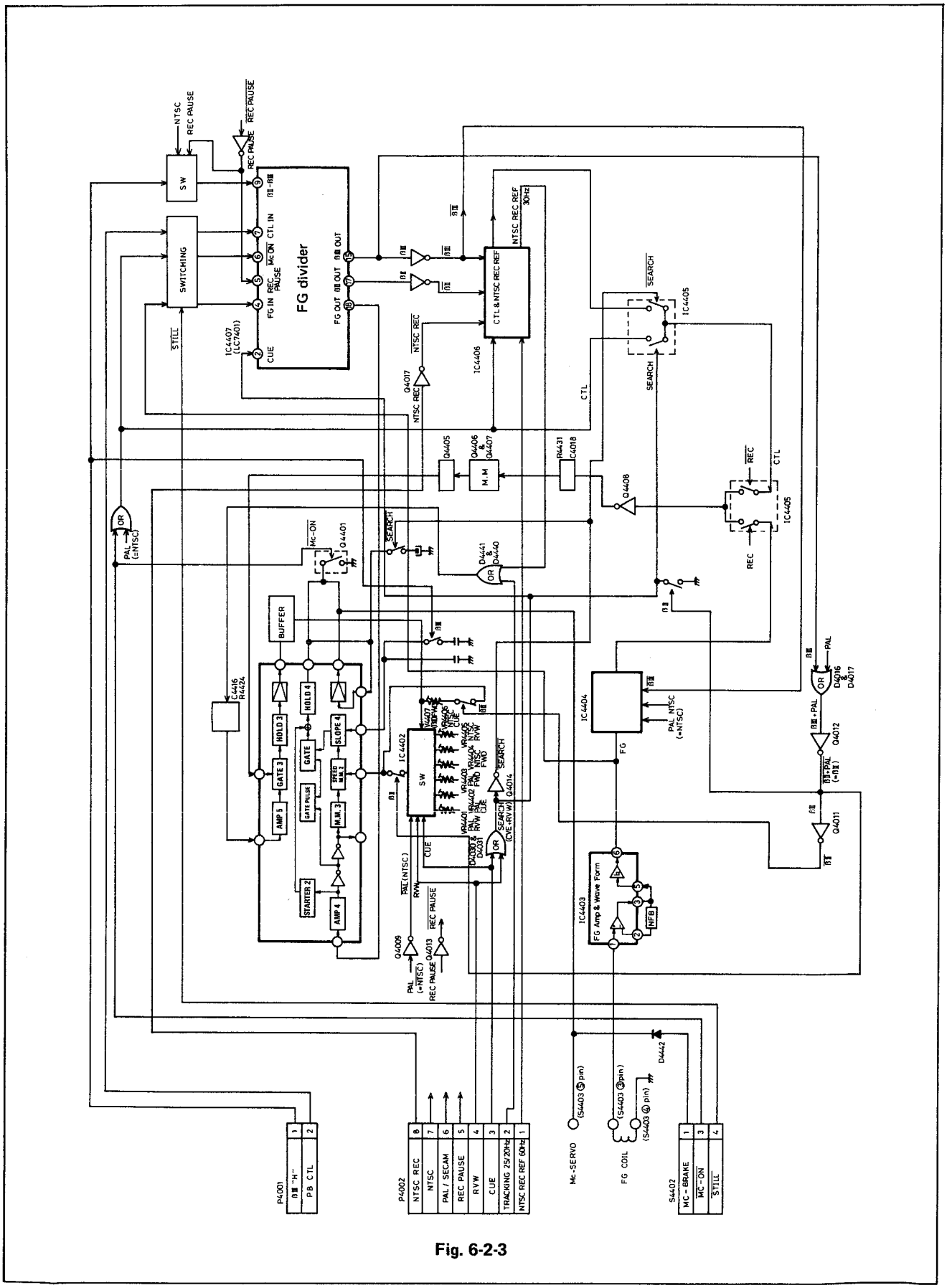

FG divider
SWITCHING
SW
STILL
CUE
FG IN
REC PAUSE
MC-ON
CTL IN
FG OUT
CTL & NTSC REC REF
NTSC REC REF 30Hz
IC4407 (LC74011)
IC4406
IC4405
IC4404
IC4403
IC4402
BUFFER
HOLD 3
HOLD 4
GATE 3
GATE
SLOPE 4
AMP 5
GATE PULSE
AMP 4
STARTER 2
FG Amp & Wave Form
NFB
SEARCH
REC
CTL
PAL (=NTSC)
PAL NTSC (=NTSC)
REC PAUSE
RVW
FWD
NTSC
PAL
Q4017
Q4405
Q4406 & Q4407
M. M
R4431
C4018
Q4408
Q4401
D4441 & D4440
Q4009
Q4013
Q4014
Q4011
Q4012
D4016 & D4017
C4416
R4424
P4001
P4002
S4402
Mc-SERVO
FG COIL
D4442
NTSC REC
PAL / SECAM
REC PAUSE
CUE
TRACKING 25/20Hz
NTSC REC REF 60Hz
Mc-BRAKE
Mc-ON
STILL
PB CTL

Fig. 6-2-3

C. SYSTEM CONTROL CIRCUIT

1. OUTLINE

a. Main functions of the system control circuit

(1) Controls the modes (mode logic control) of the VTR using the input from the operation buttons, the remote control unit, and the mechanism switches.
(2) Controls the four motors (head, capstan, reel, and loading motors) and drives the mechanism.
(3) Detects the conditions of the various sensors (dew, tape-end, and reel base rotation sensors) to automatically stop to VTR at the appropriate times.
(4) Sends control signals to the video, audio, servo, and timer circuits.

b. Main features

(1) Uses two n-channel, 4-bit microcomputers (LM6402A220 and LM6402A221) for control.
(2) Uses a CMOS 4-bit, 1-chip microcomputer (UPD652C066) for its infrared remote control decoder.
(3) Uses LA7011 in its tape-end sensor circuit and LA2400 in its dew sensor circuit.
(4) Uses BA6209 for forward/reverse rotation control of the reel motor and M54543L for forward/reverse rotation control of the loading motor.

c. New circuits

(1) LM6402A220 and LA6402A221 and used for this model's control microcomputers.
(2) UPD652C066 is used for the infrared remote control decoder.

CIRCUIT DESCRIPTION

1. MICROCOMPUTERS

Because the control microcomputers are the same as were used in the previous model, refer to that manual for detailed information (VTC-5550).
A 2-chip construction is used in order to improve the functions of the microcomputers in this model, so the microcomputer (LM6402A220 and LM6402A221) program are new. The mode data transmission table from the main microcomputer (LM6402A220) to the sub microcomputer (LM6402A221) is shown in Table 6-3-1.

IC3001 / Mode	MODE 3	MODE 2	MODE 1	MODE 0
	15 pin	14 pin	13 pin	12 pin
CASSETTE UP	0	0	0	0
PLAY	0	0	0	1
FF	0	0	1	0
REW	0	0	1	1
STOP-PAUSE	0	1	0	0
PAUSE	0	1	0	1
STILL	0	1	1	0
(A: DUB)	0	1	1	1
(A-BUB ST-BY)	1	0	0	0
(SLOW)	1	0	0	1
REC	1	0	1	0
F-SEARCH	1	0	1	1
R-SEARCH	1	1	0	0
STOP	1	1	0	1
(EJECT)	1	1	1	0
SYSTEM STOP	1	1	1	1

Table 6-3-1

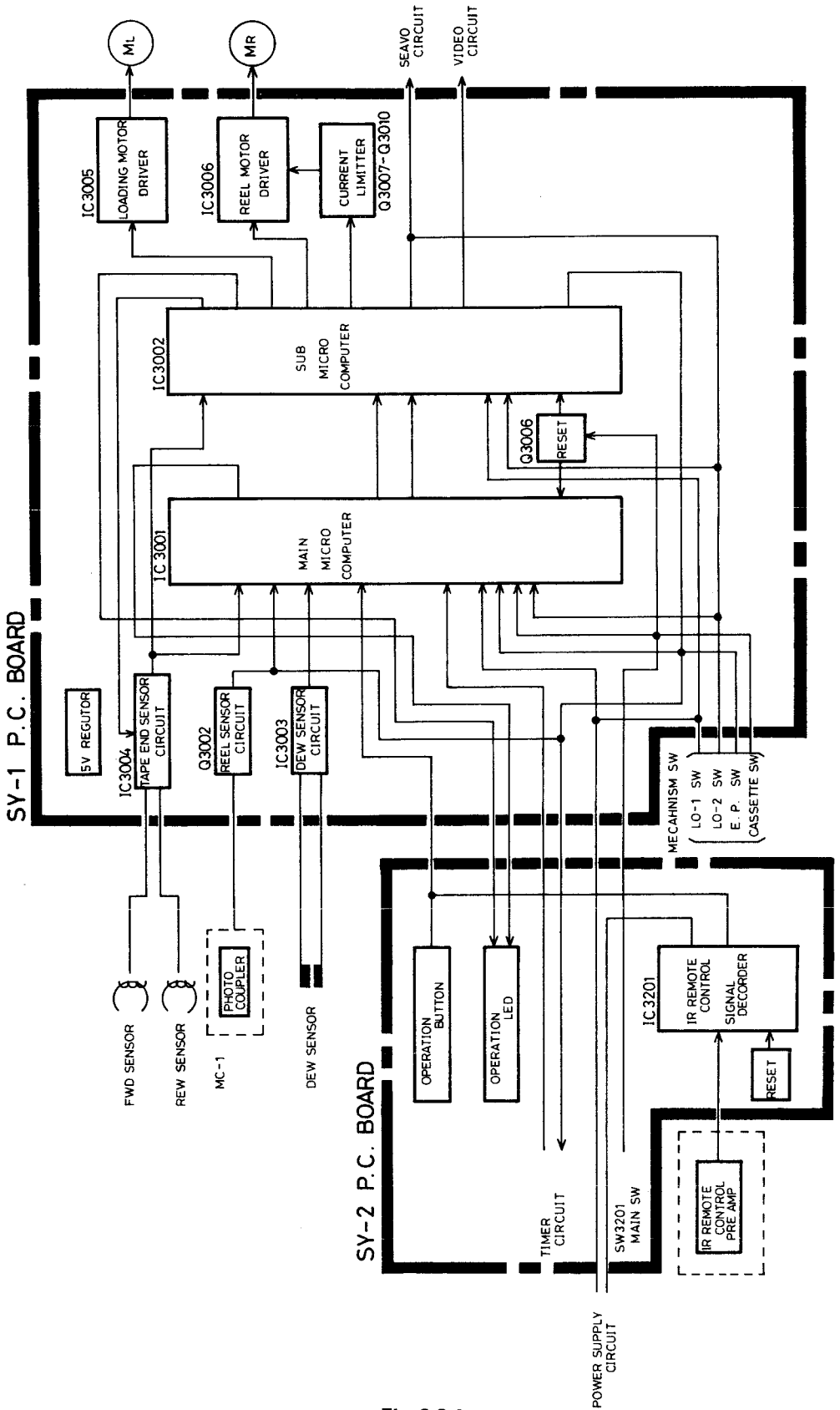

SY-1 P.C. BOARD
SY-2 P.C. BOARD
ML
MR
SEAVO CIRCUIT
VIDEO CIRCUIT
IC3005
LOADING MOTOR DRIVER
IC3006
REEL MOTOR DRIVER
CURRENT LIMITTER
Q3007-Q3010
IC3002
SUB MICRO COMPUTER
Q3006
RESET
IC3001
MAIN MICRO COMPUTER
5V REGUTOR
IC3004
TAPE END SENSOR CIRCUIT
Q3002
REEL SENSOR CIRCUIT
IC3003
DEW SENSOR CIRCUIT
MECAHNISM SW
LO-1 SW
LO-2 SW
E. P. SW
CASSETTE SW
FWD SENSOR
REW SENSOR
MC-1
PHOTO COUPLER
DEW SENSOR
OPERATION BUTTON
OPERATION LED
IC3201
IR REMOTE CONTROL SIGNAL DECORDER
RESET
IR REMOTE CONTROL PRE AMP
TIMER CIRCUIT
SW3201 MAIN SW
POWER SUPPLY CIRCUIT

Fig. 6-3-1

2. MODE DESCRIPTIONS

The principal modes for this model are shown below.

(a) LOADING mode
(b) UNLOADING mode
(c) STOP mode
(d) REC mode
(e) PLAY mode
(f) PAUSE mode
(g) STILL mode
(h) STOP PAUSE mode
(i) F SEARCH mode
(j) R SEARCH mode
(k) F FWD mode
(l) REW mode
(m) CASSETTE UP mode

The logic table for the operation buttons is shown in Table 6-3-2, and the timing chart for the microcomputer output signals is shown in Fig. 6-3-3. The signal flow charts for the respective modes are shown in Fig. 6-3-4 Fig. 2-3-13.

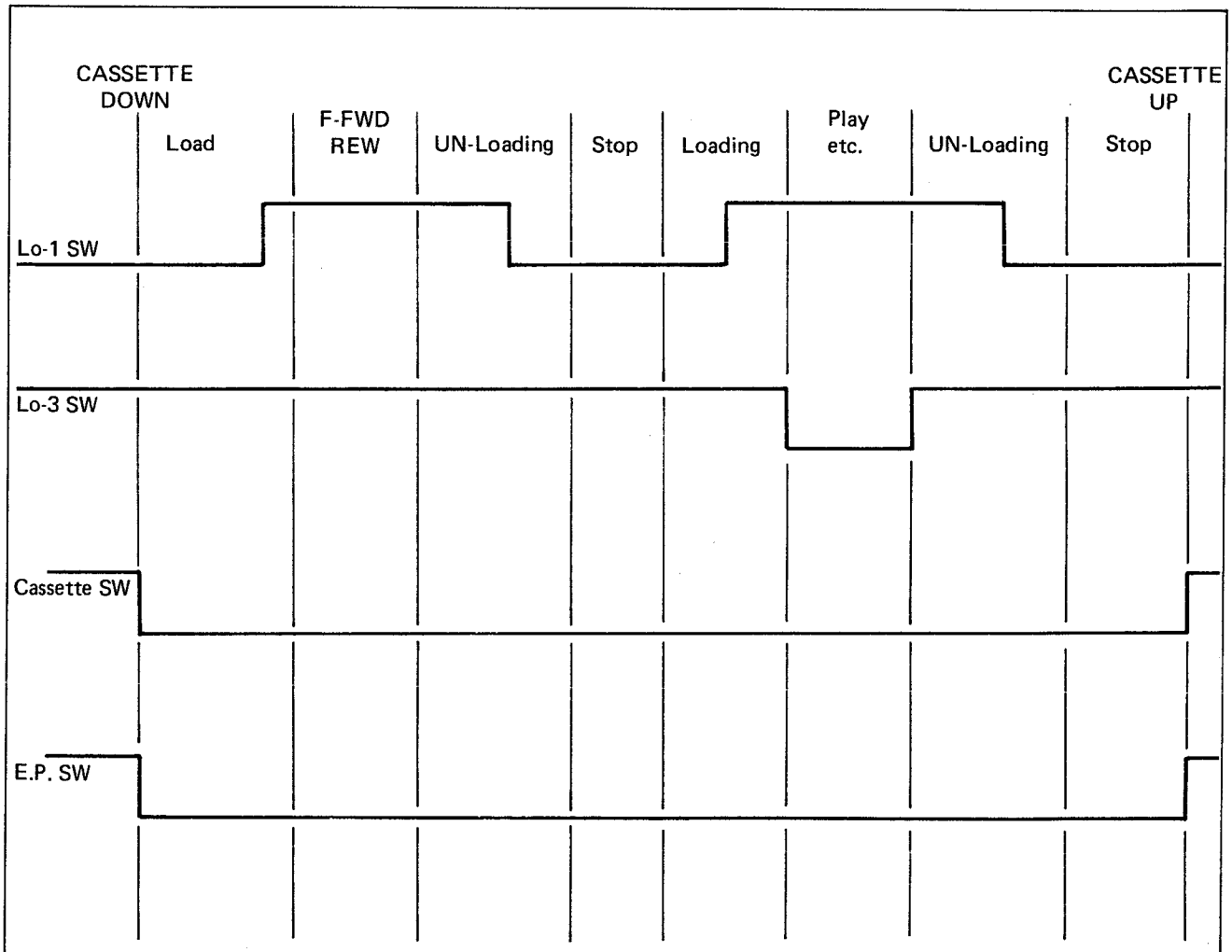


Fig. 6-3-2 MECHANISM SW TIMING CHART

Button-Sensor Input / Mode	STOP	PLAY	PAUSE	REC+PLAY	REMOVED TAB REC+PLAY	REC	F.F/ F-SEARCH	REW/ R-SEARCH	REMOTE PAUSE ON	REMOTE PAUSE OFF	TAPE END SENSOR	REEL SENSOR	DEW SENSOR
STOP	——	LOADING →PLAY	LOADING →STOP-PAUSE	LOADING →REC	REC LED*1 blink or LOADING →PLAY	——	LOADING →F. FWD	LOADING →REW	——	——			——
PLAY	UNLO. →STOP	——	STILL	——	——	——	F.SEARCH	R-SEARCH	STILL	——	UNLO. →LOADING →F. FWD	LOADING STOP	UNLO. →STOP
REC	UNLO. →STOP	——	SHORT RVW →PAUSE	——	——	——	——	——	SHORT RVW →PAUSE	——	UNLO. →LOADING →F. FWD	LOADING STOP	UNLO. →STOP
STILL	UNLO. →STOP	——	PLAY	SHORT RVW →PAUSE	UNLO. →REC*1 LED blink or PLAY	SHORT RVW →PAUSE	——	——	——	PLAY			UNLO. →STOP
PAUSE	UNLO. →STOP	STILL	REC	——		——	——	——	——	REC			UNLO. →STOP
STOP-PAUSE	UNLO. →STOP	STILL	——	SHORT RVW →PAUSE	UNLO. →REC LED blink or STILL	SHORT RVW →PAUSE	——	——	——	——			UNLO. →STOP
F. FWD	UNLO. →STOP	UNLO. →LOADING →PLAY	——	——	UNLO. →REC LED blink or PLAY	——	——	REW	——	——	UNLO. →LOADING →F. FWD	UNLO. →STOP	UNLO. →STOP
REW	UNLO. →STOP	UNLO. →LOADING →PLAY	——	——	UNLO. →REC LED blink or PLAY	——	F.F	——	——	——	SHORT F.F →UNLO. →STOP	UNLO. →STOP	UNLO. →STOP
F. SEARCH	UNLO. →STOP	——	——	PLAY	Not accepts or PLAY	——	——	R. SEARCH	——	——	UNLO. →LOADING →F. FWD	LOADING STOP	UNLO. →STOP
R. SEARCH	UNLO. →STOP	PLAY	——	PLAY	Not accepts or PLAY	——	F. SEARCH	——	——	——	UNLO. →STOP	LOADING STOP	UNLO. →STOP
TIMER REC	——	——	——	——	——	——	——	——	——	——	UNLO. →STOP	UNLO. →STOP	UNLO. →STOP

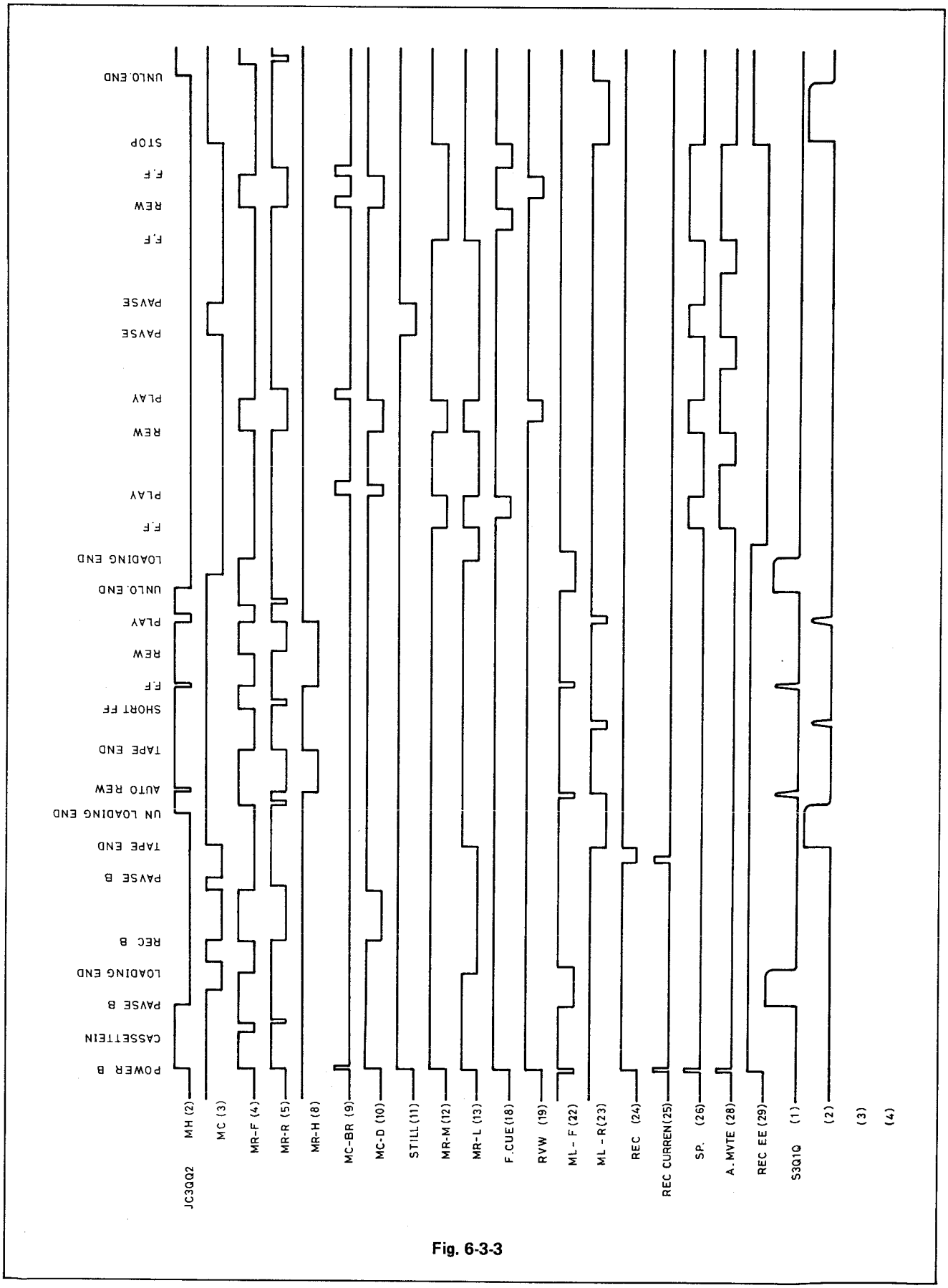

JC3QQ2
MH (2)
MC (3)
MR-F (4)
MR-R (5)
MR-H (8)
MC-BR (9)
MC-D (10)
STILL (11)
MR-M (12)
MR-L (13)
F.CUE (18)
RVW (19)
ML-F (22)
ML-R (23)
REC (24)
REC CURREN (25)
SP. (26)
A.MVTE (28)
REC EE (29)
S3Q1Q (1)
(2)
(3)
(4)
POWER B
CASSETTEIN
PAVSE B
LOADING END
REC B
PAVSE B
TAPE END
UN LOADING END
AUTO REW
TAPE END
SHORT FF
F.F
REW
PLAY
UNLO.END
LOADING END
F.F
PLAY
REW
PLAY
PAVSE
PAVSE
F.F
REW
F.F
STOP
UNLO.END

Fig. 6-3-3

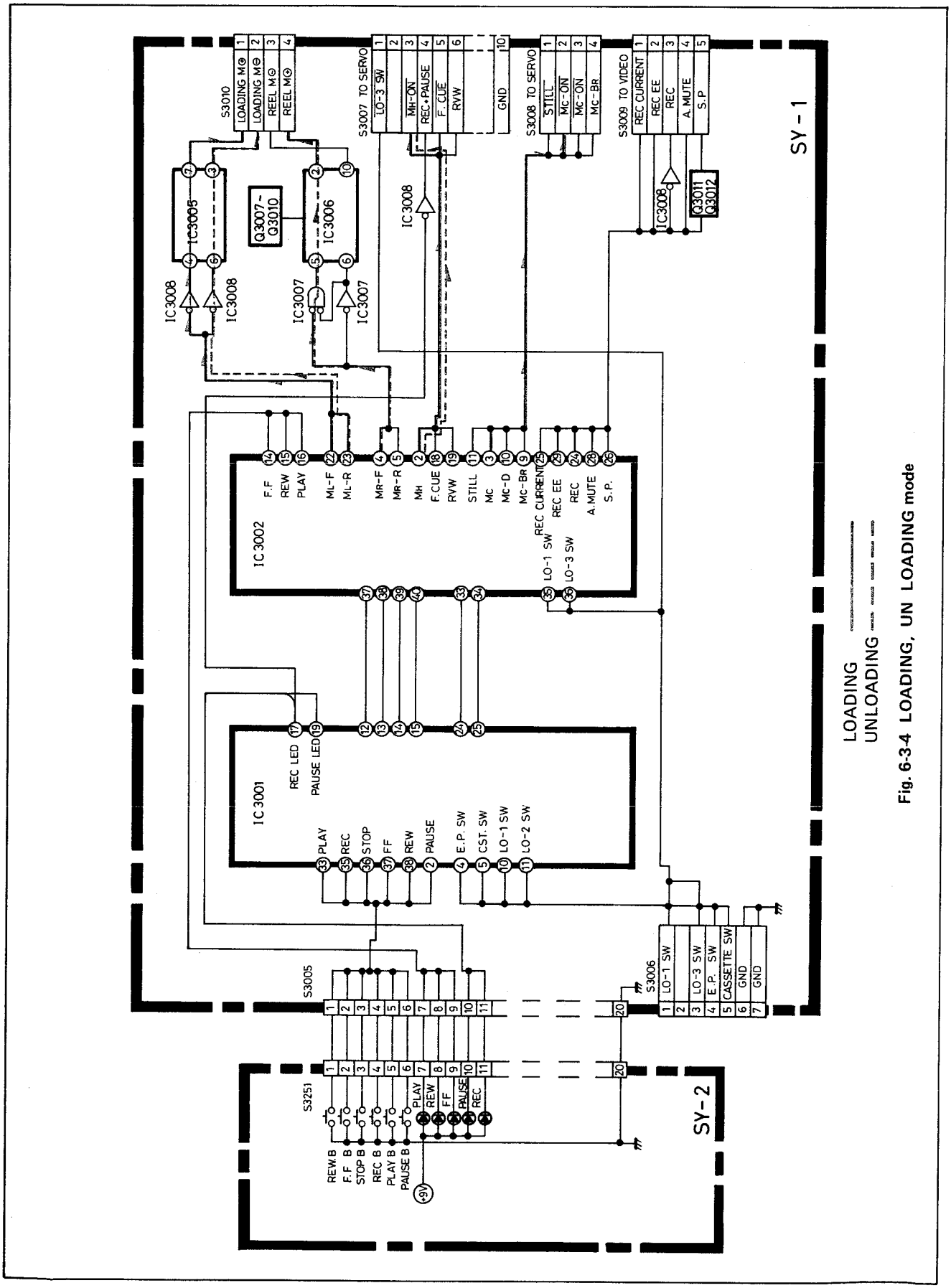


Fig. 6-3-4 LOADING, UN LOADING mode

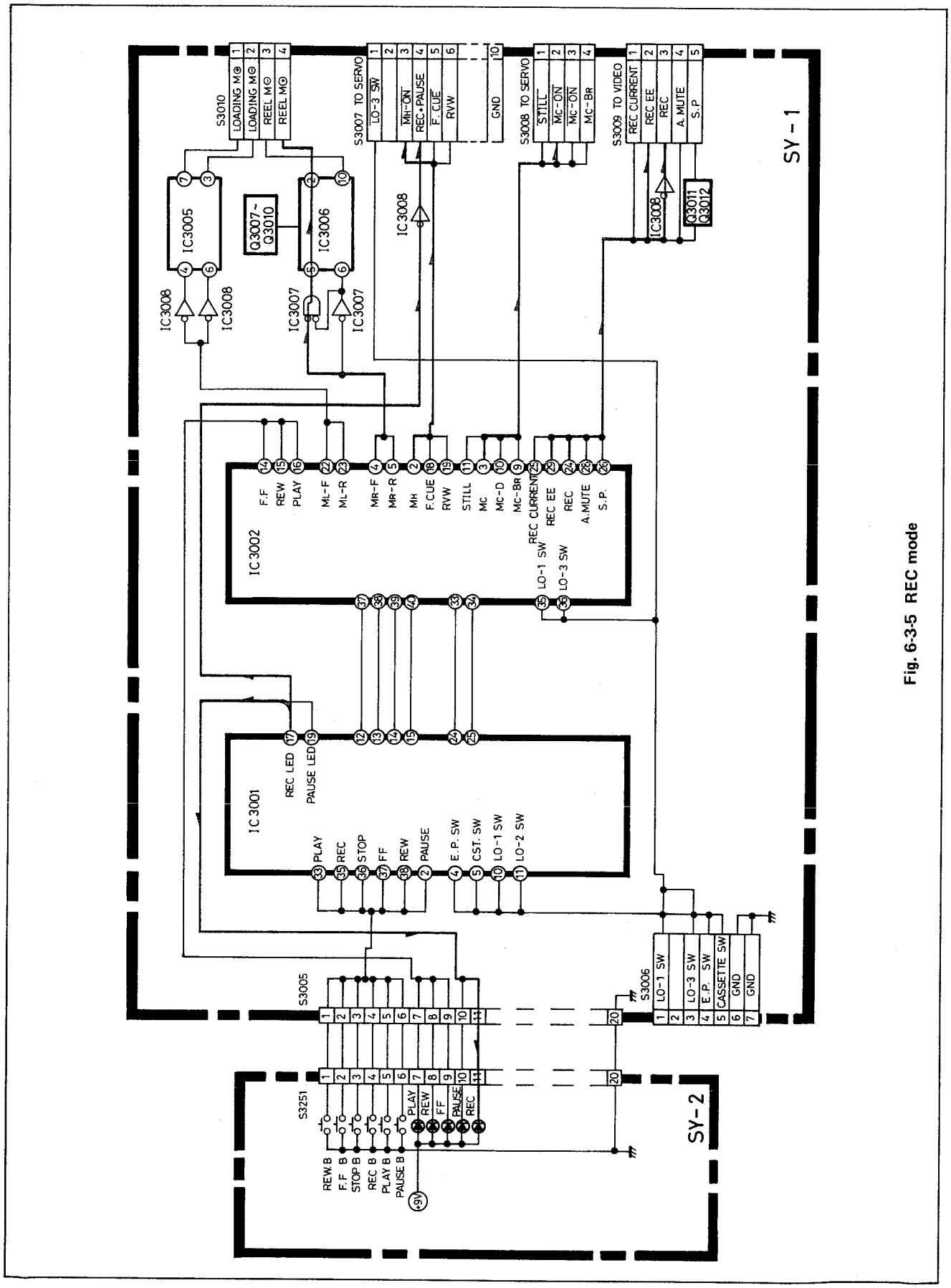


Fig. 6-3-5 REC mode

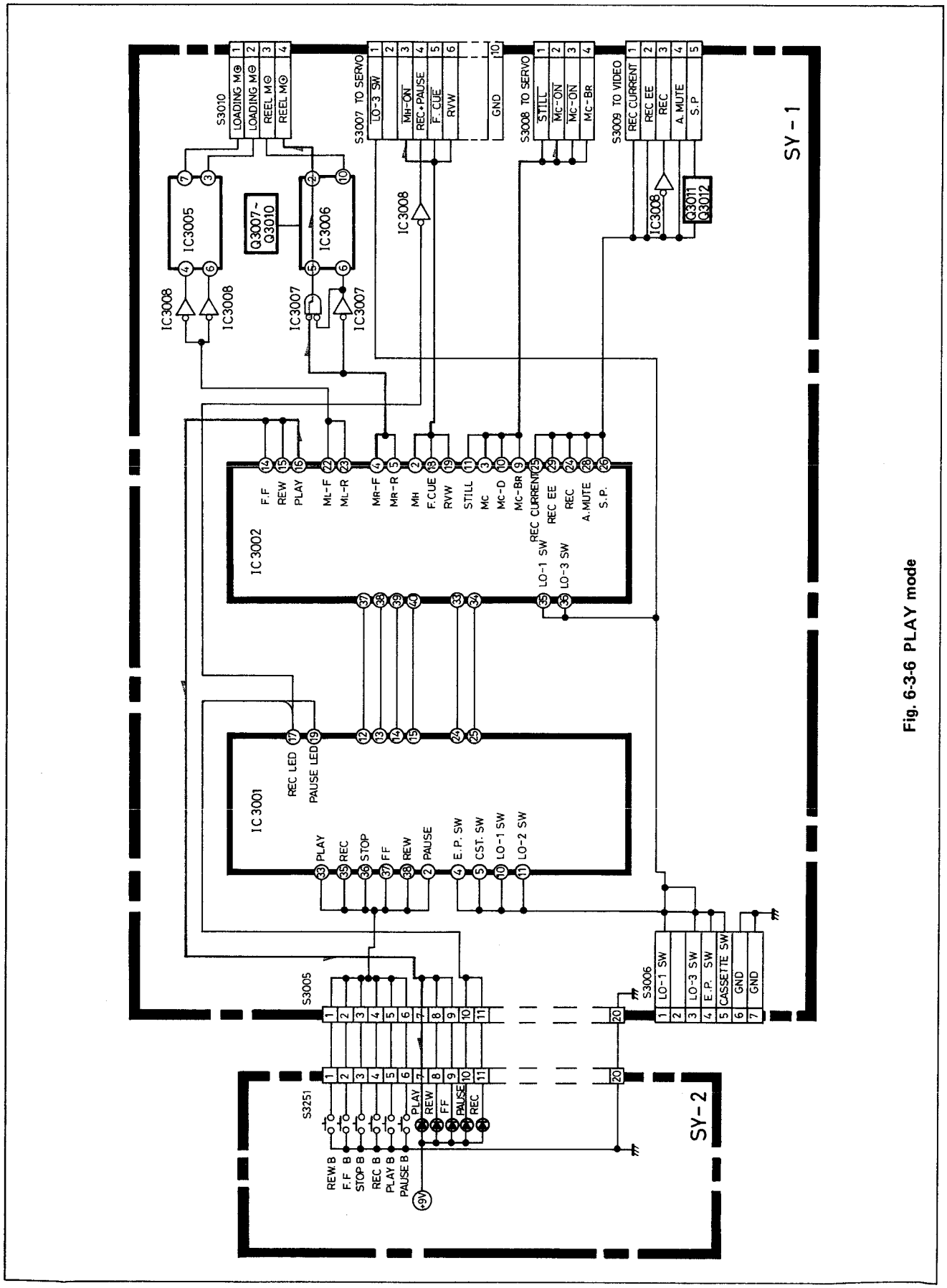


Fig. 6-3-6 PLAY mode

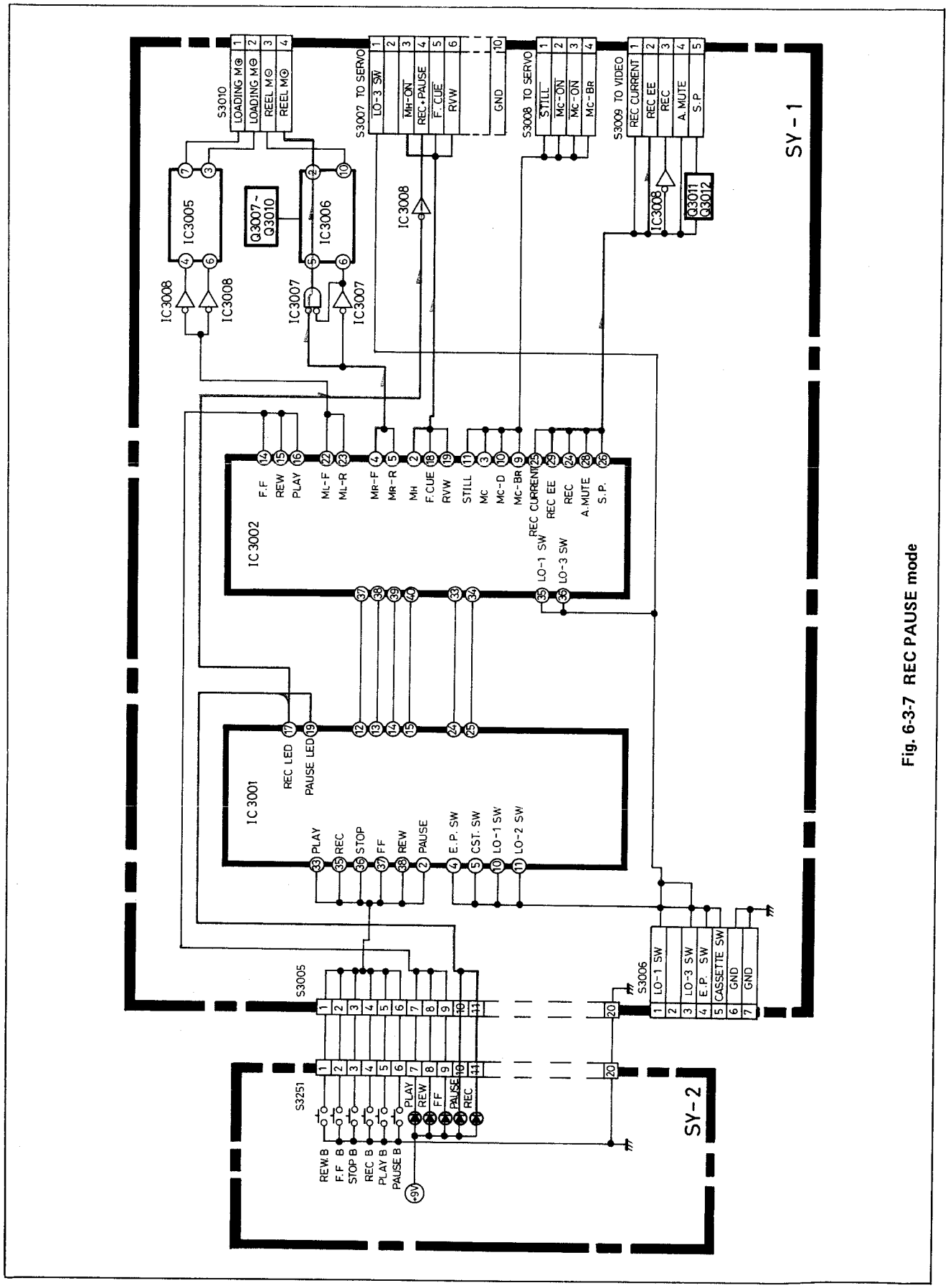


Fig. 6-3-7 REC PAUSE mode

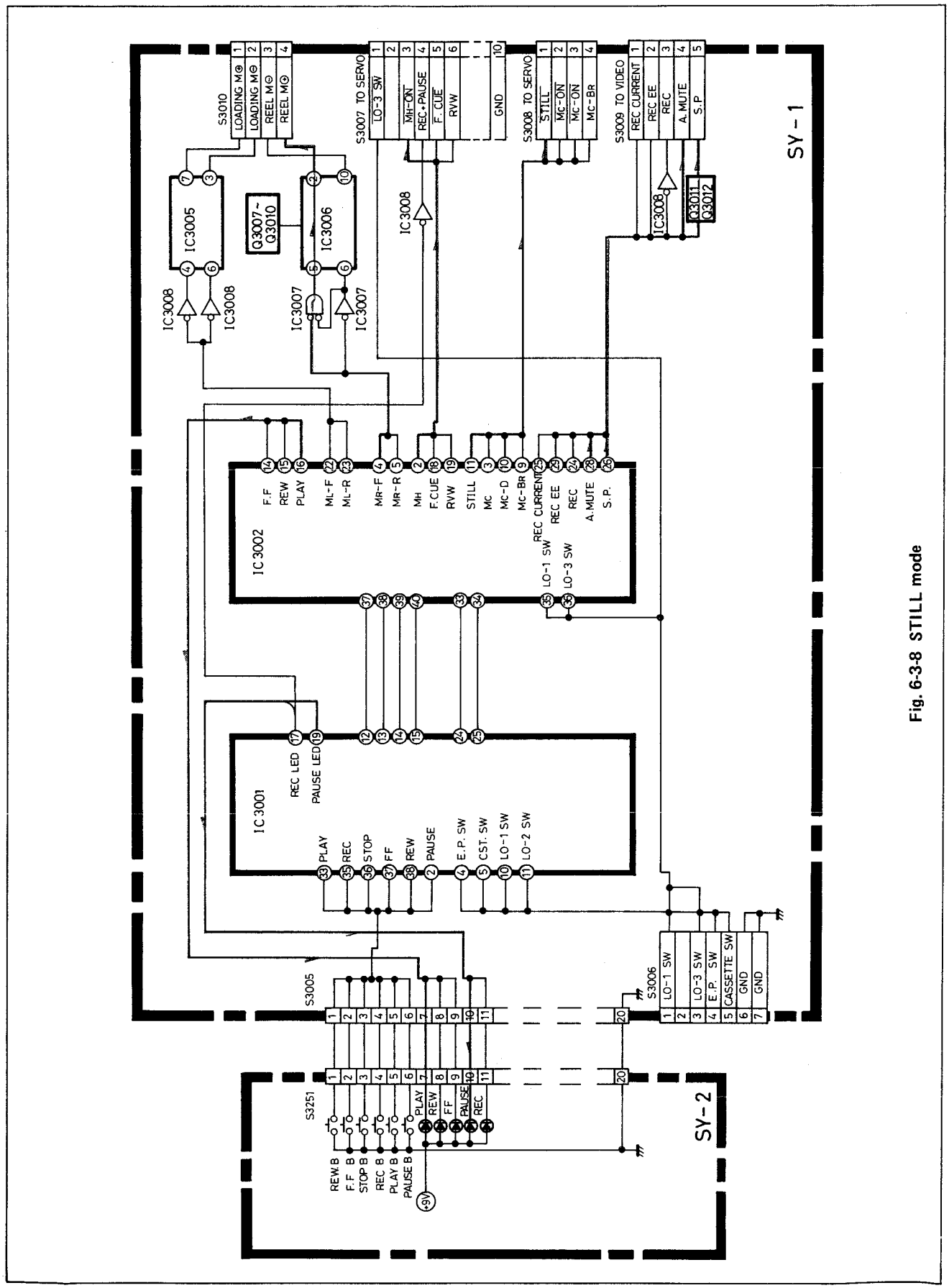


Fig. 6-3-8 STILL mode

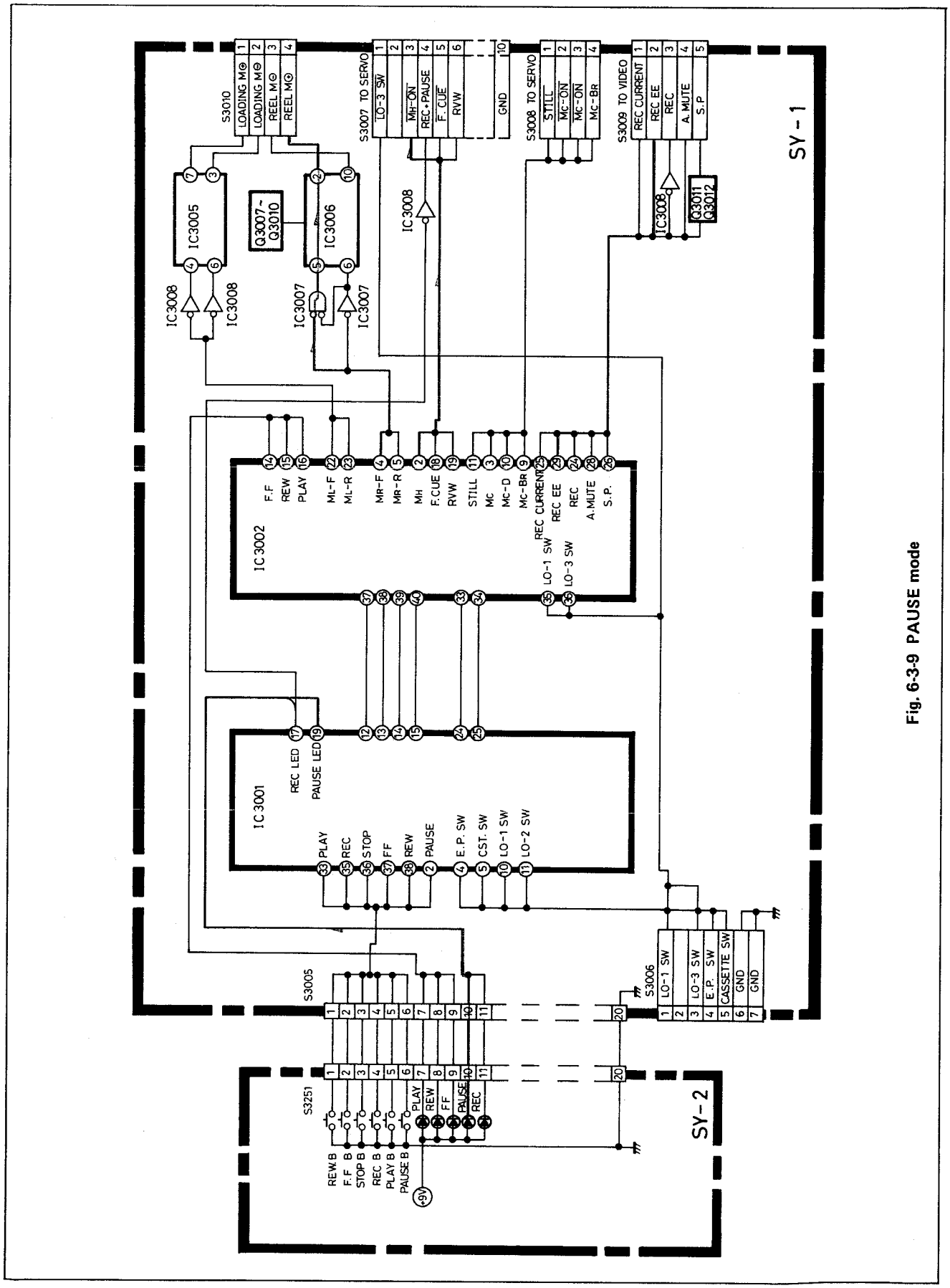


Fig. 6-3-9 PAUSE mode

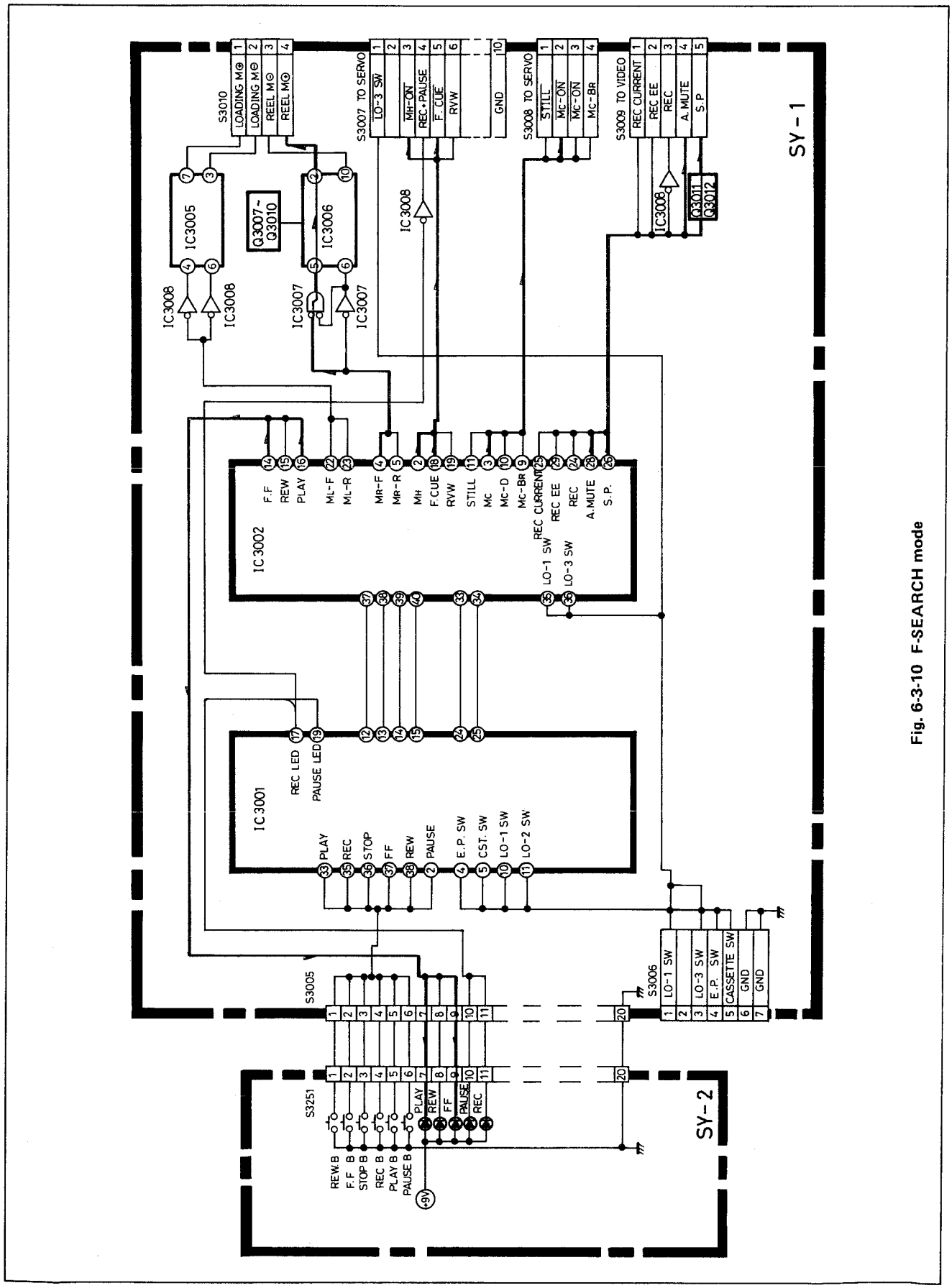


Fig. 6-3-10 F-SEARCH mode

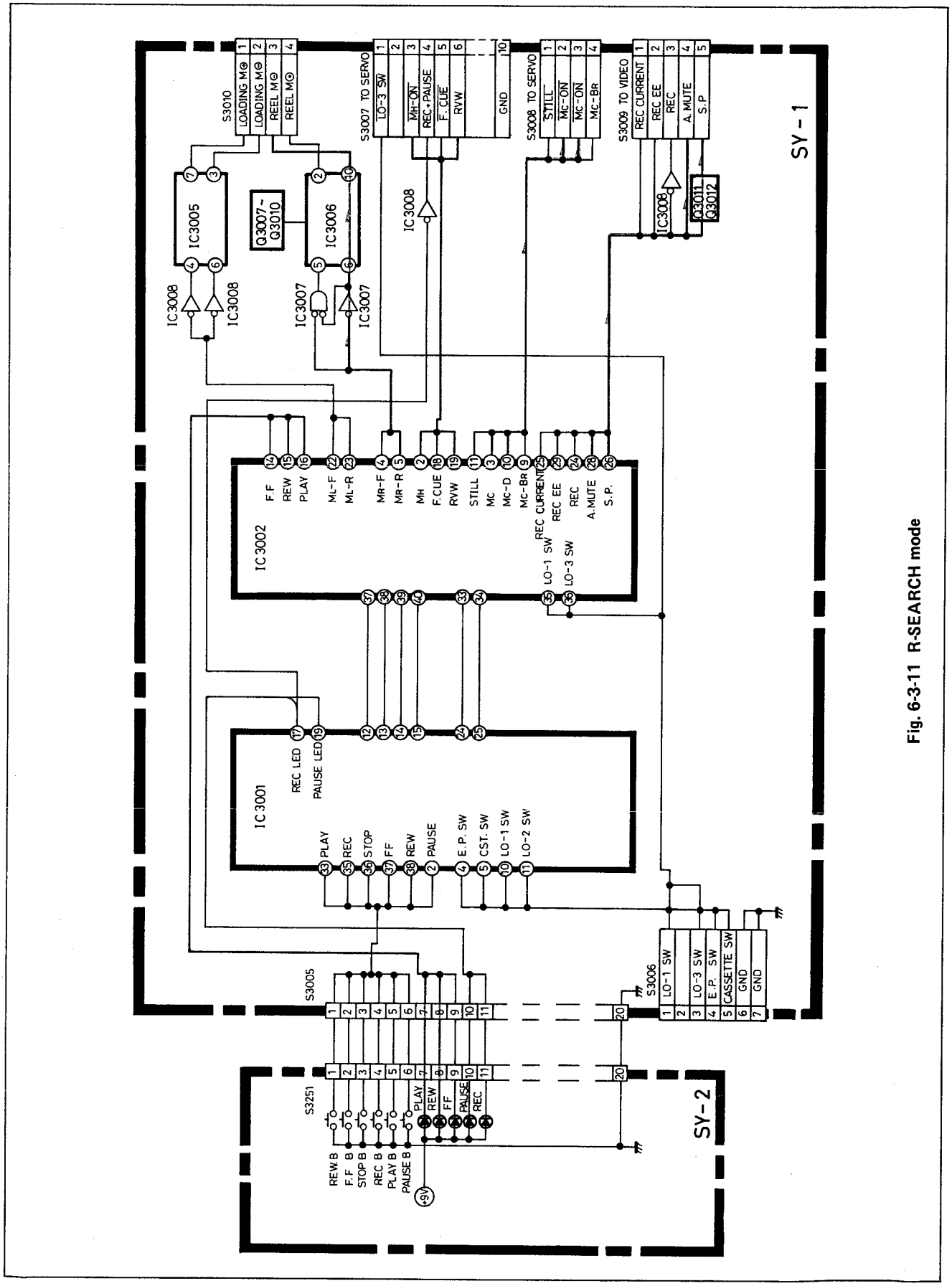


Fig. 6-3-11 R-SEARCH mode

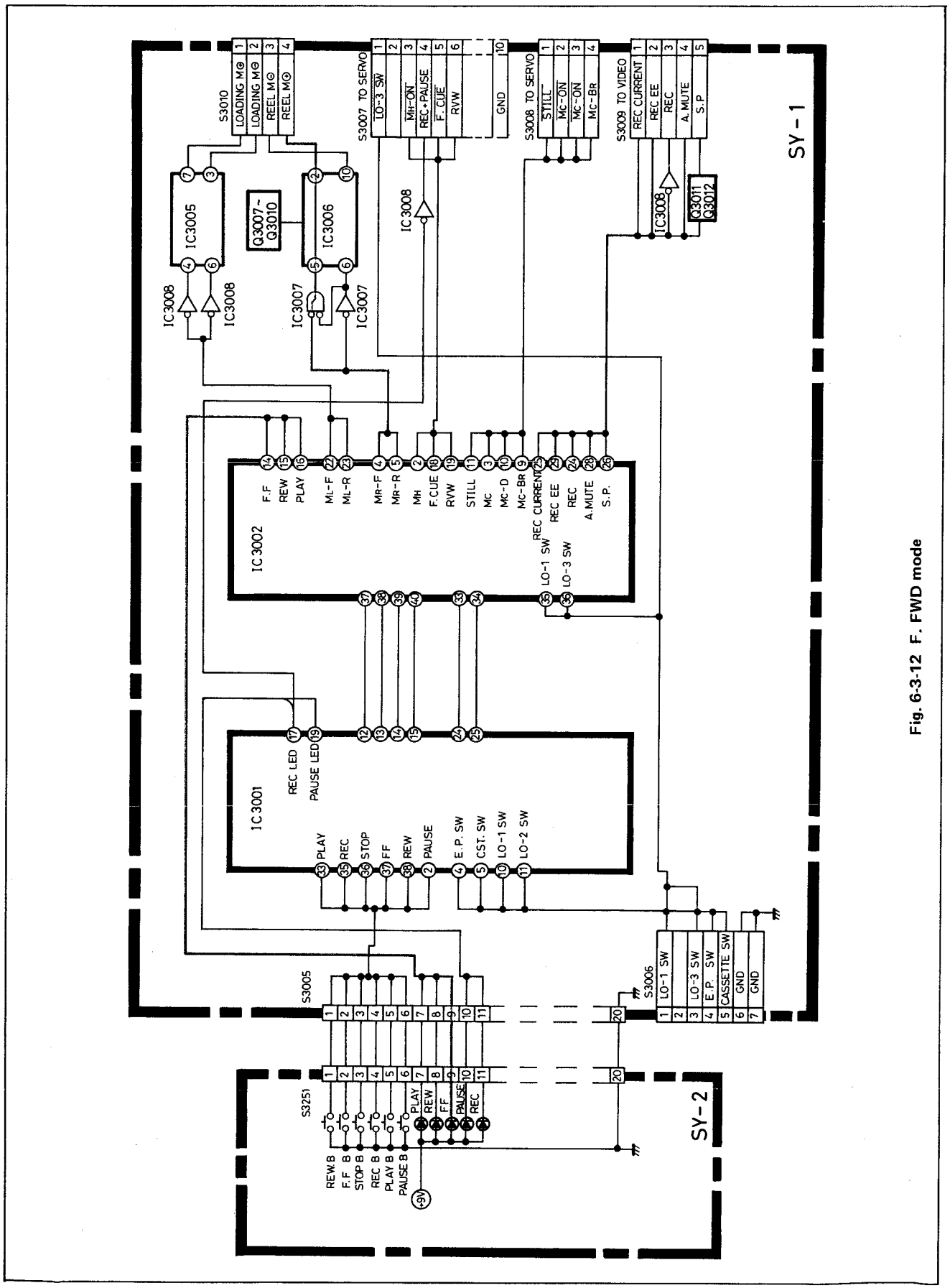


Fig. 6-3-12 F. FWD mode

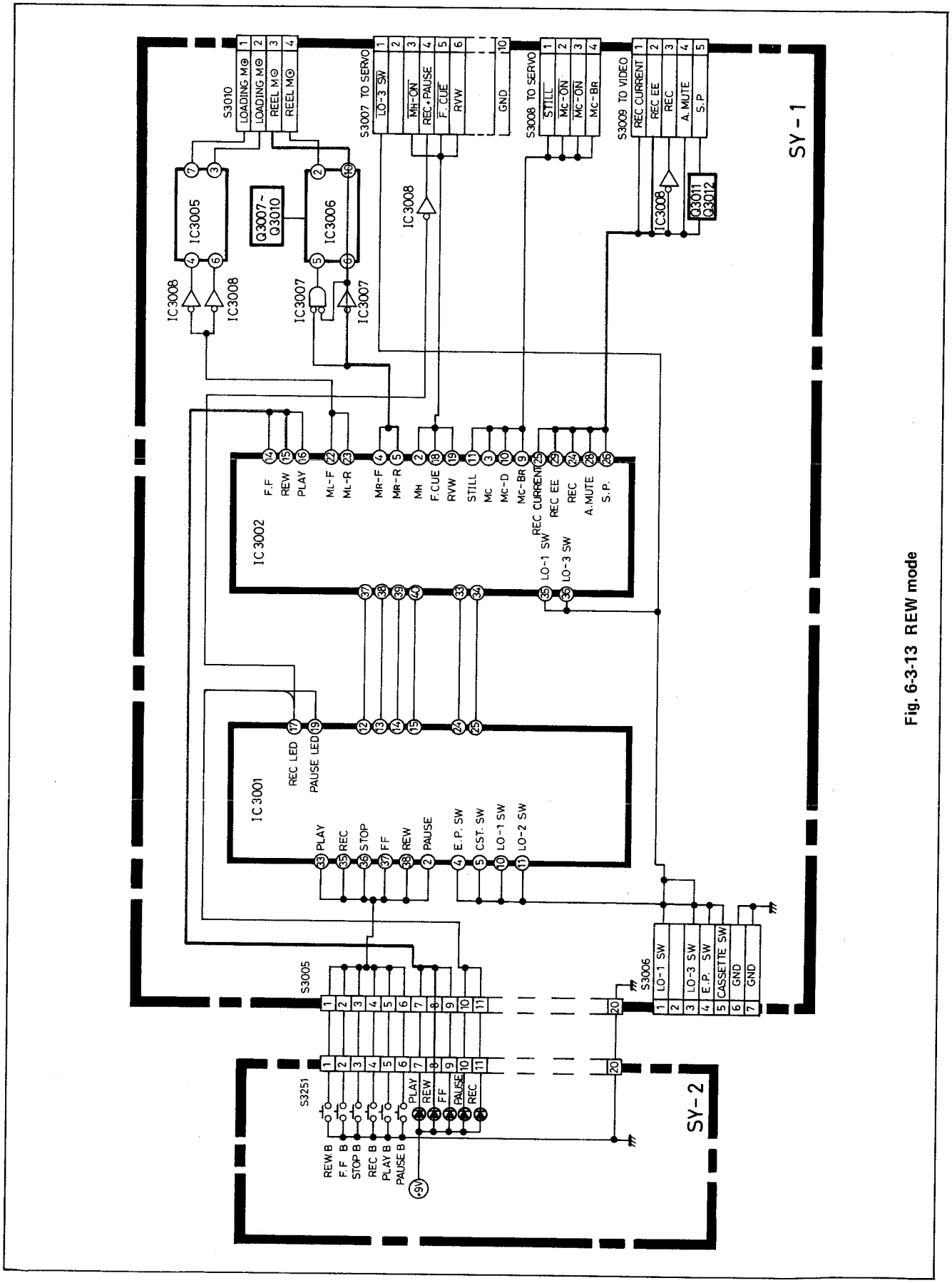


Fig. 6-3-13 REW mode

3-2. Safety devices

In order to prevent damage to the tape, this model is equipped with the following safety devices:
(a) Tape-end sensor
(b) Dew sensor
(c) Take-up reel base rotation sensor
(d) Automatic pause release function
Because the circuit constructions and function of these devices are basically the same as for the previous model (VTC-5550), only the differing points will be explained herein.
In the previous model, if the reel rotation stopped during timer recording (detected by the reel base rotation sensor), the mode would change UNLOADING → STOP. Under all other circumstances, the automatic stop would be in the LOADING-STOP mode (LOADING → LOADING-STOP). However, this model is designed to automatically stop using UNLOADING → STOP during fast forward and rewind as well as during timer recording. (Refer to the table of mode changes.)

3-3. Motor drive circuits

In this model the system control circuit directly drives two motors, the reel motor and the loading motor.
Both the loading motor drive circuit and the reel motor drive circuit are basically the same as in the previous model. However, the function of determining the reel motor terminal voltage has been assigned to a micro-computer. The voltage applied is determined by D3016 except during the loading-completed condition, by D3015 during forward search and reverse search, and by D3014 during all other modes. Because the current limiting circuit composed of Q3007 through Q3010 is also the same as in the previous model, refer to that manual for detailed information.

REEL MOTOR DRIVE CIRCUIT

3-4. Infrared remote control

The infrared ray signals from the remote control transmitter are detected by the photodiode (SPI-03PF) inside the infrared preamplifier package, amplified by IC1 (μPC1373H), and then decoded by IC3280 (μPD652C-066).

(a) Preamplifier circuit

The composition of the preamplifier is centered around IC3401 (μPC1373H), and the block diagram of this IC is shown in Fig. 6-3-14.
The infrared signal transmitted on a 38 kHz carrier from the transmitter is detected by PIN photodiode D3465. The voltage of the PIN photodiode photoelectric current is converted by the resistance (approx. 60 kΩ) in the IC. This signal is amplified approx. 60 dB by the amplifier circuit and output to the tuning coil of pin (3). The amplifier gain at this stage is determined by the resonance impedance of pin (3) and the resistance of pin (6).
The amplifier output signal appears in the tuning coil of pin (3), but when this terminal voltage becomes 50 mVp-p, the detection circuit in the next stage performs detection. The carrier for the detected signal is removed in the capacitor of pin (2), and the signal is output to pin (1) of the open collector at logic level.

(b) Decoder circuit

Microcomputer μPD652C-066 is used for decoding the remote control signals.
The serial signals output from the preamplifier are input to pin (24), the signals are decoded, and the necessary signals are then output to the main microcomputer (IC3001) and the power supply circuit.

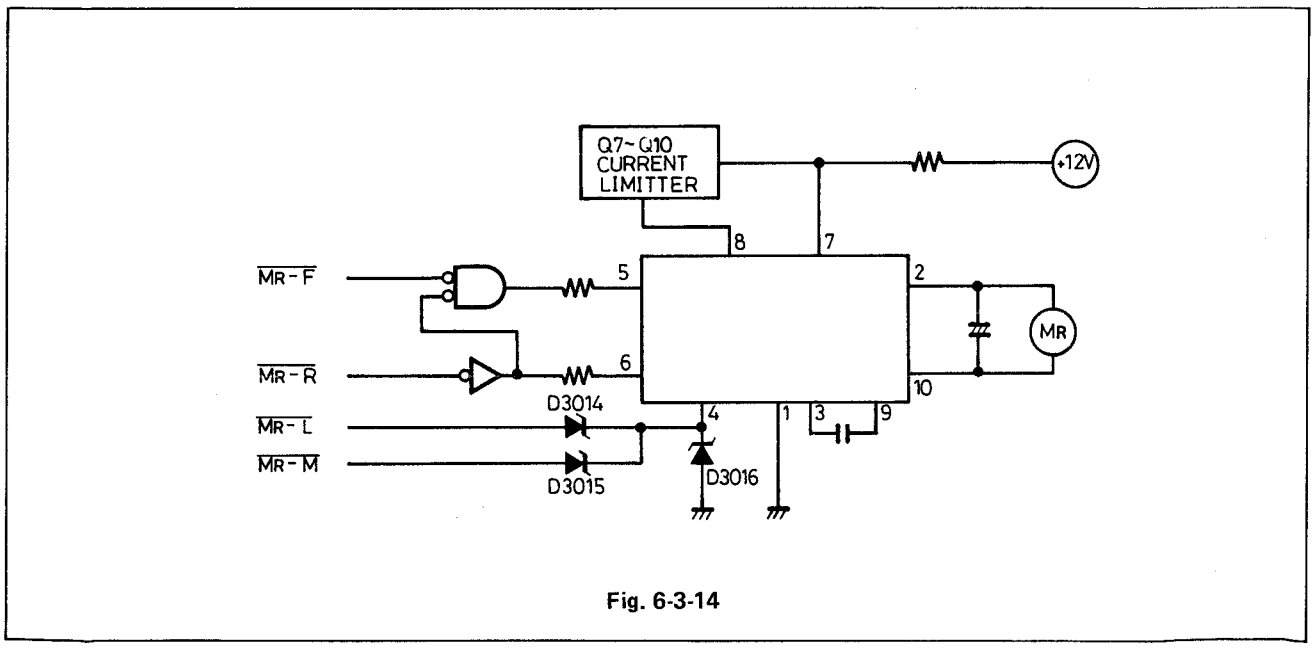


Fig. 6-3-14

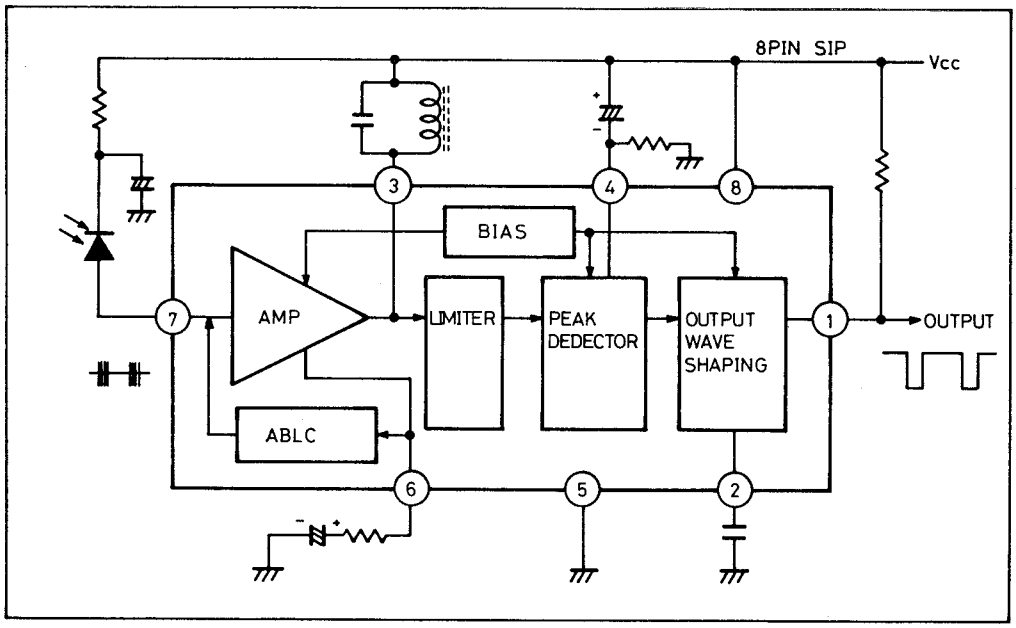


Fig. 6-3-15

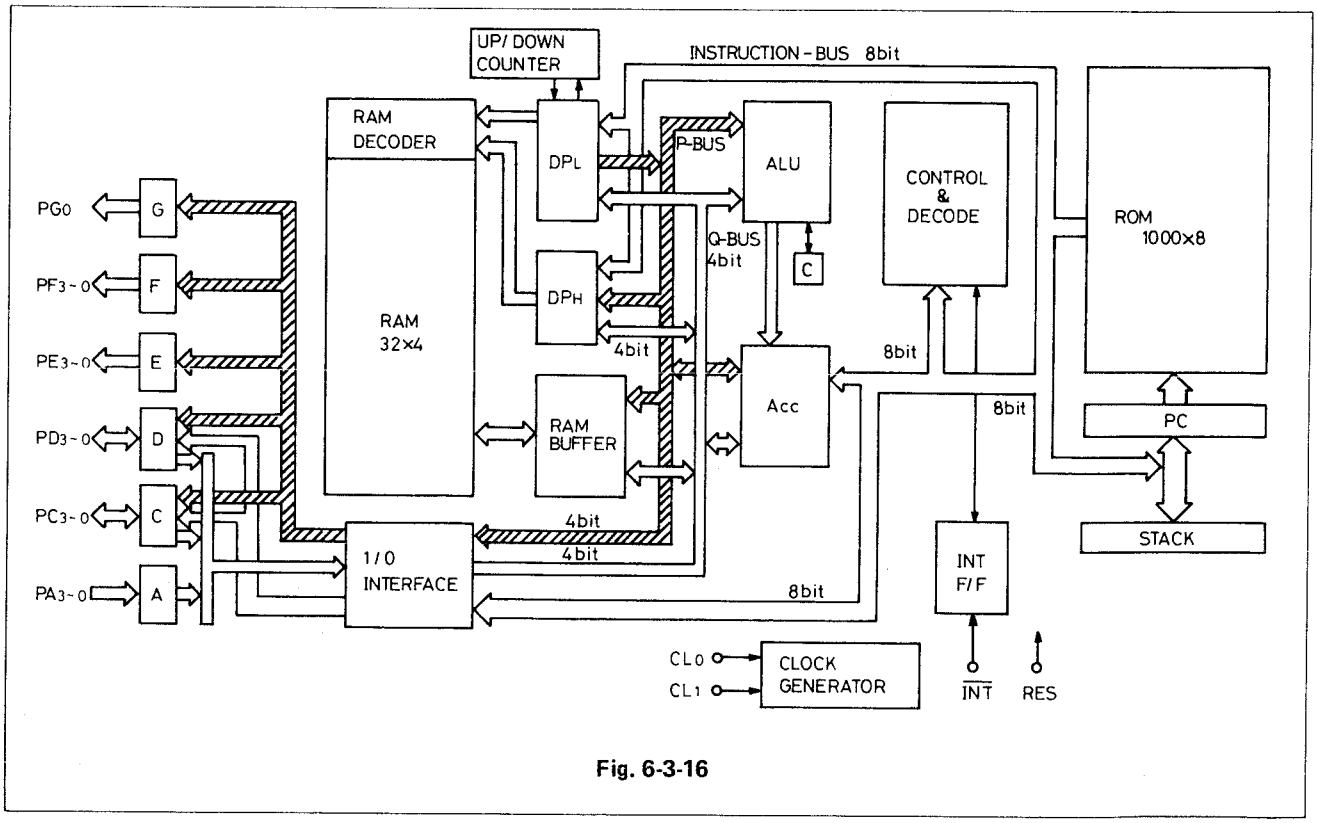


Fig. 6-3-16

3-5. Reset circuit

In previous models, resetting of the microcomputers was done only when the power was switched OFF → ON; however, this model is designed so that resetting is also done when the power is switched OFF.